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A longitudinal study (1956-62) of 4,948 education majors during their junior and senior years was conducted to identify biographical, academic, and psychometric factors characteristic of students who persist and student who do not persist in a teacher education curriculum. The data variables which were analyzed against the criterion of persistence were, in addition to the above-mentioned factors, from achievement test scores and postbaccalaureate questionnaires. Eight questions framed the collection and analysis of data. Results are of descriptive value, especially from questions regarding the characteristics of juniors entering the college of education, the number and location of students teaching after graduation, and the achievement levels of five standardized tests of juniors and seniors. Additional findings indicate the following: in determining differences between "persists" and "nonpersists," only overall grade point average contributed significantly, and information available at the time of admission is not an effective predictor; men and women who persisted had different patterns of scores, with high school rank being the most effective single variable; generally, persistence or nonpersistence could not be determined by achievement tests, even after adjustment was made for ability differences; and the pattern of significant gains in educational development differed but personality test scores did not differ among students grouped according to major fields. (LP)

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A STUDY OF FACTORS OPERATIVE IN THE SELECTIVE RETENTION OF STUDENTS IN TEACHER EDUCATION
PART II

by
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Minnesota Studies of Student Personnel Work in Teacher Education

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CONTENTS

Chapter I. The Problem in Perspective 1-1

Chapter II. The Population, the Data, and the Central Questions 2-1
  The Population 2-1
  Criterion Groups: Persists and Nonpersists 2-7
  The Data 2-12
  Biographical Data 2-12
  Psychometric Data 2-13
  Academic Data 2-14
  Achievement Test Data 2-14
  Experience Data 2-16
  The Central Questions 2-17

Chapter III. Univariate Description of Selected Majors 3-1
  Majors in Five Elementary Education Curriculums 3-1
  Biographical Data 3-1
  Psychometric Data 3-7
  Achievement Data 3-7
  Majors in Eight Secondary Education Curriculums 3-7
  Biographical Data 3-7
  Psychometric Data 3-17
  Academic Data 3-17
  Majors in Five Special Fields Curriculums 3-17
  Biographical Data 3-17
  Psychometric Data 3-34
  Academic Data 3-34

Chapter IV. Comparisons of Students in the Same Major Field Who Were Persists and Nonpersists 4-1
  The Subjects 4-1
  The Variables and the Analysis 4-1
  The Results 4-4

Chapter V. Comparisons of Men and Women Persists in the Same Major Field 5-1
  The Subjects 5-1
  The Variables and the Analysis 5-1
  The Results 5-4

Chapter VI. Comparisons of Achievement Levels of Entering Juniors and Graduating Seniors in Five Teacher Education Curriculums 6-1
  The Population and the Plan 6-1
  Comparisons of Entering Juniors 6-2
  English Usage Achievement 6-2
  Mathematics Usage Achievement 6-4

CONTENTS con't.

Chapter VI. con't.
- Natural Science Reading Achievement 6-6
- Social Studies Reading Achievement 6-9
- Comparisons of Graduating Seniors 6-12
- English Usage Achievement 6-12
- Mathematics Usage Achievement 6-15
- Natural Science Reading Achievement 6-17
- Social Studies Reading Achievement 6-19
- Word Usage Achievement 6-22

Chapter VII. The Comparisons of the Achievement of Persists and Nonpersists in Five Curriculums 7-1
- Introduction 7-1
- Elementary Education 7-3
- Persists and Nonpersists Compared 7-3
- Adjustments for Scholastic Ability 7-3
- English-Language Arts Majors 7-14
- Persists and Nonpersists Compared 7-14
- Adjustments for Scholastic Aptitude 7-15
- Natural Science Majors 7-22
- Persists and Nonpersists Compared 7-22
- Adjustments for Scholastic Aptitude 7-29
- Social Studies Majors 7-32
- Persists and Nonpersists Compared 7-32
- Adjustments for Scholastic Aptitude 7-33
- Mathematics Majors 7-41
- Persists and Nonpersists Compared 7-41
- Adjustments for Scholastic Aptitude 7-42

Chapter VIII. Comparisons of Achievement Levels of Students in Five Teacher Education Curriculums Who Were Tested as Entering Juniors and Graduating Seniors 8-1
- The Analyses 8-1
- The Results 8-1

Chapter IX. Comparisons of MMPI Scores for Men and Women in Five Curriculums 9-1
- The Analysis and the Results 9-1

Chapter X.
- The Results 10-1
- How many are Graduate Teaching? 10-1
- Where do graduates teach? 10-12

Chapter I

The Problem in Perspective

This report is the second part of a longitudinal study of students in teacher education. Part I (Wilk and Cook, 1963) presented the general rationale for the research, the premises, guiding principles, and the variables. To give perspective to this report, Part II, this chapter first presents selected excerpts from Part I, though that study should be consulted for the complete description of the approach of this longitudinal research.

"The study reported here began because of the concern about the lack of available information to assist either the institution or the student in making the sequence of decisions necessary in teacher education. The problem was to describe the results of decision-making so that the factors which operate in the selective retention of students in teacher education could be identified. It was felt that basic, fundamental research was needed to provide a description of the psychological factors that distinguish those who decided and were permitted to complete their required professional education from those who did not complete the program, either by their decision or that of the institution.

"Specifically, the purpose of this research was to describe students in one teacher education institution, to describe them in such a way that factors affecting their selective retention could be identified. Such initial description would, it was felt, contribute to further understanding of the problems involved, for one of the values of descriptive research is its power to generate questions for further study. It was clearly recognized that if the study were to provide useful descriptions about the selective retention of students in teacher education and to be of heuristic value for further research, then particular attention had to be given the approach and the principles that guided the conduct of the study....

"The development of the framework for the Minnesota Studies of Student Personnel Work in Teacher Education, of which this study is a part, was based on five premises.

1) Colleges and Universities preparing teachers implement their purposes for teacher education through the decisions they make about individuals. The principle points of decision-making can be represented by admission, retention, and graduation. All three require that institutions decide about their students, and they do either by design or default.

2) Individuals who wish to become teachers implement their vocational goals through decisions they make about institutions. They must apply, enroll if admitted, and continue to graduation in a program of teacher education if they are to be certified for teaching.

3) Teachers entering the profession are the products of a sequence of interdependent decisions made by individuals and teacher education institutions. Individuals must apply; institutions must admit; individuals must register; institutions must retain; students must

continue; institutions must graduate. An adverse decision by either the individual or the institution means that initial preparation for teaching cannot be completed.

4) In the education of teachers, the optimum program recognizes that students and curriculums are equally important ingredients. Not all students who are admitted to a program of preparation for teaching should become teachers, and not all who are admitted will become teachers. Not all who should become teachers will benefit most from one program of courses or one method of presentation.

5) Acceptance of the four preceding premises implies that some implementation is required to facilitate the decision-making of the individual and the institution. An adequate student personnel program is uniquely appropriate for this purpose. A student personnel program can be and should be designed which will carry out a commitment to individuals to facilitate their growth and development considering their personal goals and values, and to the institution as it develops a program to meet its objectives. Such a dual commitment to the individual and to the institution has, historically, been the objective of student personnel work, and it is particularly suitable for application to teacher education....

"The theoretical model which most adequately integrates the stated premises is the decision theory model. Since the premises assume that both institutions and students are decision makers, the model may be applied to the decisions of either. The primary concern in this research, however, is in the decision-making of the institution. Decision theory presents a model which represents the way in which decisions are made, identifies the essential elements in the process, describes their relationship to one another. Briefly, the model states that the decision maker has an objective or a purpose in mind. Data relevant to the decision are first collected. From these, data estimates are made of the likelihood that various possible outcomes would result. Each alternative outcome is weighted by a value judgment which indicates its desirability when compared to the stated objective. The course of actions is then chosen on the basis of the comparison of the several predicted outcomes and their associated values. Faced with a recurrence of decisions of a given kind, the decision maker seeks to establish a strategy, a rule, for decision-making. A strategy is built from information regarding the outcome of past decisions. From these experiences, the decision maker can learn the likelihood of occurrence of the various alternative outcomes and decide what data would be most useful in predicting these various outcomes. The strategy then states what decision will be made given certain data.

"The role which the decision theory model has played in the research reported here has been, not so much to provide mathematical models for the solution of specific decision problems, but rather to guide the development of some principles which were important in the conduct of the research.

"...In summary the principles...state that it is appropriate to study factors operative in the selection of students in teacher education by studying students. Such a study should be longitudinal and observe the curriculum major as a major variable of study.

"...the choice which is made at any decision point is governed by the criterion, expressed or implied. Thus any descriptions of the decision-making process or descriptions of the results of decision-making must consider the criterion. Although the development of the criterion against which decisions are made may be an involved and arduous task, involving stating the purposes, developing curriculums which are consistent with the purposes, and specifying the students for whom the curriculums are intended, the application of the criterion requires simple and straightforward decisions. Each institution reduces its objectives to a series of clear-cut decisions; admit or reject; retain or drop; graduate or not graduate.

"The study reported here chose to begin with the decisions the institution made as the criteria. From the point of view of the institution, retention or graduation describes the institution's decisions concerning the individual's status in teacher education. From the point of view of the individual, registration may be used to describe the individual's decisions about the program of teacher education. For purposes of this study two groups of students were identified, (1) those who chose to continue in teacher education and were permitted to remain in the institution, labeled persists, (2) those who chose not to continue or were not permitted to continue, called nonpersists.

"In summary, the descriptions which were made to identify factors related to selective retention in teacher education were made against the criterion of persistence. Persistence was defined by the individual's continued registration in a program of teacher education and by the institution's permission to remain and to be graduated.

"...specifically, then, the problem for the research reported here was to identify those biographical, academic, and psychometric factors which are characteristic of those who persist in teacher education and those who do not."

In summary, "teacher education institutions decide who should be teachers either by design or default. The requirements for admission, retention, and graduation are operational definitions of institutional purpose. Individuals also decide whether they wish to become teachers through the decisions they make about institutions. The approach of this study was to use the decision theory model to identify and to relate the relevant variables. The purpose of the study is to describe the factors which operate in the selective retention of students in teacher education. Persistence was accepted as the criterion and the study focused on student biographical, academic, and psychometric characteristics." (Cook and Wilk, 1963)

The plan for the longitudinal study as it was projected for the first six years is pictured in Figure 1.1. The figure indicates that the basic pattern was to follow students in teacher education from the time of their admission to the programs as juniors to give years beyond graduation. Part I of the study included data from three entering classes and at the end of the first three year period, the first class had completed one year of teaching. At the close of the data collection for Part II, six classes had entered the teacher education programs and four classes had been graduated and the first class was four years beyond graduation.

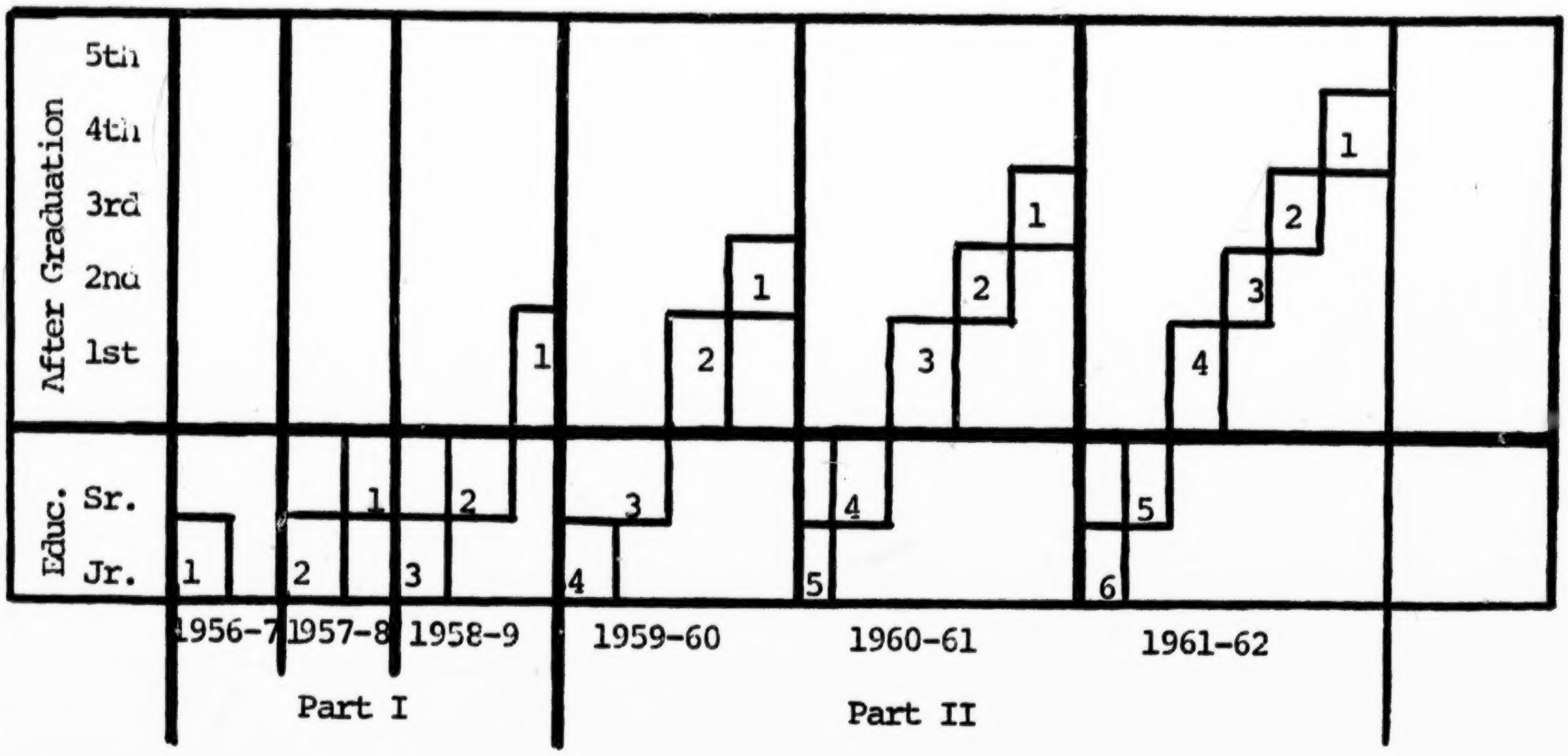
After Graduation
5th
4th
3rd
2nd
1st
Educ.
Sr.
Jr.
1
2
3
4
5
6
1956-7
1957-8
1958-9
1959-60
1960-61
1961-62
Part I
Part II

Fig. 1.1 The first six years of the projected plan for following six junior classes of students in teacher education for five years beyond graduation.

Chapter II

The Population, the Data, and the Central Questions

The Population

The fundamental purpose of the study was to describe the retention of students in teacher education programs. This purpose required a specific definition of the population entering the programs. Since the professional aspects of the teacher education programs at Minnesota begin at the junior year level, students were considered a part of this study when they enrolled in the first professional sequence (Education 55A or Education 75A) regardless of the point at which they were admitted to the College. Part I describes fully the several curriculums of the College and indicates the various points of admission for these majors. Though application for admission to the College initiates the record system of the Student Personnel Office, it was the number of credits completed by students admitted, the traditional index of status, which determined when a given student became a part of this longitudinal study. This gave a uniform criterion for students' entry point into the study, for though they may enter their respective curriculums at different levels, entrance into the junior sequence is more consistent in that every student must have completed the minimum number of credits to be a junior. The nature of the programs provided further uniformity in that students could not appreciably shorten the time requirements for graduation even if they had completed more credits than the minimum. Thus entrance into the junior professional sequence gave a consistent, meaningful definition of the student population both in terms of the level of requirements completed and the work which remained in order to complete the program.

The records which served as basic documents and the procedures used for maintaining the status of the population have been described in Part I.

Tables 2.1 through 2.8 present the basic descriptions of the students, first by broad curriculum fields, then by specific curriculum majors, and finally in terms of the criterion of persistence.

The total number of students admitted to the junior professional sequence in all majors for the six year period was 4948. Table 2.1 shows that Elementary majors comprised a consistent portion of the total, about 45%, varying from a high of 49% in 1956-57 to a low of 40% in 1958-59. Students in Secondary and Special Fields majors also varied little for the six years both in percent of the total and in the proportion of male and female juniors. The total number enrolled showed more variability from year to year. Numbers increased from 799 the first year to 827 and then to 963 the third year which is a 23% increase overall. All of the increase over the three years was lost the fourth year. There was an increase to 858 in 1960-61 (7% over the fourth year) and a drop to 708, the lowest level of the period in 1961-62. No consistent pattern was evident in the male and female enrollments which comprised the fields. (Check for changes in admission requirements)

Table 2.1

The Number and Percent of Male and Female Students Who Were Juniors in Elementary, Secondary, and Special Fields During Each of the Six Years Studied

	1956-57		1957-58		1958-59		1959-60		1960-61		1961-62		Total	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Elementary														
Male	38	4	52	6	52	5	30	4	35	4	36	5	243	5
Female	356	45	346	42	337	35	309	38	340	40	299	42	1987	40
Secondary														
Male	124	16	111	13	184	19	138	17	139	16	91	13	787	16
Female	80	10	108	13	132	14	121	15	148	17	132	19	721	14
Special Fields														
Male	116	15	122	15	126	13	95	12	97	11	72	10	628	13
Female	85	10	88	11	132	14	110	14	99	12	78	11	592	12
Total	799	100	827	100	963	100	803	100	858	100	708	100	4958	100

Elementary Education

Table 2.2 presents enrollments for the male and female students who were entering juniors in each of the six Elementary curriculums during the six year period. Three of the curriculums designated "A" are designed to prepare teachers for the entire range of elementary grades, and the three designated "B" are for the preparation of Nursery, Primary, Kindergarten (NKP) teachers. The designation "I" indicates the "regular" program, "II" denotes the degree program for certified teachers, and "III" identifies the programs leading to a Bachelor of Science and a recommendation for certification for holders of the Bachelors Degree. The IA program enrolled over 70% of all Elementary students and the year by year enrollments followed the general pattern noted for all Elementary majors. The IIA, IIIA, IIB, and IIIB curriculums showed a steady decline in enrollment over the six years.

Secondary Academic Fields

Table 2.3 presents the population data for the ten Secondary Academic Fields. In addition to the general picture for these fields represented in Table 2.1, some specific trends seem noteworthy. Foreign Language, Mathematics, Physical Science, and Social Science fields increased in enrollment the first three years; and the enrollments for Mathematics and Physical Science declined for the second three year period. The most erratic pattern of increase and decrease is shown in the Social Science enrollments. In general, enrollments dropped the sixth year -- some quite sharply.

Special Fields

The data in Table 2.4 shows that for the Special Fields there was less enrollment variability over six years than for the other two groups of fields. Sharpest changes occurred in Physical Education-Women enrollments with sizeable increases in the first three years that declined almost as sharply the fifth year. Most widely fluctuating were the enrollments in Nursing Education. The drastic reductions came primarily because of a shift of the preparation of Nursing Education majors from the Bachelor Degree to the Graduate Degree level.

Table 2.2

The Number and Percent of Male and Female Students Who Were Juniors in Elementary Education During Each of the Six Years Studied

	1956-57		1957-58		1958-59		1959-60		1960-61		1961-62		Total	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Elementary IA														
Male	27	11	40	15	43	16	22	8	30	10	33	12	195	12
Female	212	89	219	85	230	84	240	92	264	90	252	88	1417	88
Total	239	100	259	100	273	100	262	100	294	100	285	100	1612	100
Elementary IIA														
Male	2	5	1	3	1	7	0	0	0	0	0	0	4	4
Female	35	95	30	97	14	93	5	100	1	100	0	0	85	96
Total	37	100	31	100	15	100	5	100	1	100	0	0	89	100
Elementary IIIA														
Male	9	18	11	22	6	14	8	27	5	20	3	50	42	20
Female	42	82	39	78	38	86	22	73	20	80	3	50	164	80
Total	51	100	50	100	44	100	30	100	25	100	6	100	206	100
Elementary IB														
Male	0	0	0	0	2	4	0	0	0	0	0	0	2	1
Female	51	100	49	100	47	96	34	100	52	100	42	100	275	99
Total	51	100	49	100	49	100	34	100	52	100	42	100	277	100
Elementary IIB														
Male	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Female	3	100	2	100	3	100	1	100	0	0	1	100	10	100
Total	3	100	2	100	3	100	1	100	0	0	1	100	10	100
Elementary IIIB														
Male	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Female	13	100	7	100	5	100	7	100	3	100	1	100	36	100
Total	13	100	7	100	5	100	7	100	3	100	1	100	36	100

Table 2.3

The Number and Percent of Male and Female Students Who Were Juniors in Secondary Academic Fields During Each of the Six Years Studied

	1956-57		1957-58		1958-59	
	N	%	N	%	N	%
Core						
Male	9	56	2	40	3	75
Female	7	44	3	60	1	25
Total	16	100	5	100	4	100
English						
Male	13	37	6	16	15	28
Female	22	63	31	84	38	72
Total	35	100	37	100	53	100
Foreign Languages						
Male	6	30	5	28	11	41
Female	14	70	13	62	16	59
Total	20	100	18	100	27	100
Language Arts						
Male	0	0	2	17	5	31
Female	10	100	10	83	11	69
Total	10	100	12	100	16	100
Mathematics						
Male	16	84	26	76	43	81
Female	3	16	8	24	10	19
Total	19	100	34	100	53	100
Natural Science						
Male	20	91	13	65	31	76
Female	2	9	7	35	10	24
Total	22	100	20	100	41	100
Physical Science						
Male	0	0	1	50	16	94
Female	0	0	1	50	1	6
Total	0	0	2	100	17	100
Social Science						
Male	46	85	41	79	47	63
Female	8	15	11	21	28	37
Total	54	100	52	100	75	100
Speech						
Male	7	39	13	57	12	55
Female	11	61	10	43	10	45
Total	18	100	23	100	22	100
Speech Pathology						
Male	6	67	2	13	1	13
Female	3	33	14	87	7	87
Total	9	100	16	100	8	100

Table 2.3 (con't)

The Number and Percent of Male and Female Students Who Were Juniors in Secondary Academic Fields During Each of the Six Years Studied

1959-60		1960-61		1961-62		Total	
N	%	N	%	N	%	N	%
2	40	0	0	1	100	17	45
3	60	7	100	0	0	21	55
5	100	7	100	1	100	38	100
12	20	24	36	8	21	78	27
47	80	42	64	31	79	211	73
59	100	66	100	39	100	289	100
10	37	10	23	8	22	50	29
17	63	33	77	29	78	122	71
27	100	43	100	37	100	172	100
2	29	1	17	6	86	16	28
5	71	5	83	1	14	12	72
7	100	6	100	7	100	58	100
34	79	23	74	20	69	162	78
9	21	8	26	9	31	47	22
43	100	31	100	29	100	209	100
20	83	23	74	10	71	117	77
4	17	8	26	4	29	35	23
24	100	31	100	14	100	152	100
14	100	7	88	4	100	42	93
0	0	1	12	0	0	3	7
14	100	8	100	4	100	45	100
37	64	42	70	27	60	240	71
14	27	18	30	18	40	97	29
51	100	60	100	45	100	337	100
4	27	5	29	6	25	45	40
11	73	12	71	18	75	72	60
15	100	17	100	24	100	119	100
3	21	4	22	1	4	17	19
11	79	14	78	22	96	71	81
14	100	18	100	23	100	88	100

Table 2.4
The Number and Percent of Male and Female Students Who Were Juniors in Special Fields During Each of the Six Years Studied

	1956-57		1957-58		1958-59		1959-60		1960-61		1961-62		Total	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Art														
Male	10	30	7	24	8	24	9	30	15	36	9	25	58	28
Female	23	70	22	76	26	76	21	70	27	64	27	75	146	72
Total	33	100	29	100	34	100	30	100	42	100	36	100	204	100
Business														
Male	14	67	13	62	13	50	8	53	15	65	8	42	71	57
Female	7	33	8	38	13	50	7	47	8	35	11	58	54	43
Total	21	100	21	100	26	100	15	100	23	100	19	100	125	100
Industrial														
Male	31	100	32	100	42	100	30	100	22	100	19	100	176	100
Female	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	31	100	32	100	42	100	30	100	22	100	19	100	176	100
Music														
Male	10	45	15	50	14	40	8	42	10	40	7	47	64	44
Female	12	55	15	50	21	60	11	58	15	60	8	53	82	56
Total	22	100	30	100	35	100	19	100	25	100	15	100	146	100
PEM														
Male	31	100	35	100	35	100	31	100	27	100	26	100	185	100
Female	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	31	100	35	100	35	100	31	100	27	100	26	100	185	100
Recreation I														
Male	3	30	8	53	4	36	5	38	8	62	3	43	31	45
Female	7	70	7	47	7	64	8	62	5	38	4	57	38	55
Total	10	100	15	100	11	100	13	100	13	100	7	100	69	100
Recreation II														
Male	16	73	12	60	10	71	3	50	0	0	0	0	41	66
Female	6	27	8	40	4	29	3	50	0	0	0	0	21	34
Total	22	100	20	100	14	100	6	100	0	0	0	0	62	100

Table 2.4 (con't)

The Number and Percent of Male and Female Students Who Were Juniors in Special Fields During Each of the Six Years Studied

	1956-57		1957-58		1958-59		1959-60		1960-61		1961-62		Total	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Nursing Education														
Male	1	6	0	0	0	0	1	3	0	0	0	0	2	1
Female	17	94	45	100	29	100	28	97	25	100	10	100	154	99
Total	18	100	45	100	29	100	29	100	25	100	10	100	154	100

Criterion Groups: Persists and Nonpersists

Table 2.5 and the three tables following give numbers and percents of the juniors who were classified as persists and nonpersists at the close of the academic year 1961-62. Students who were enrolled in the Spring quarter, 1962, or who had graduated were classified as persists; and those who had not completed the degree and who were not enrolled Spring, 1962, were classified as nonpersists.

Overall, the persistence rate was 83% with the rate for females being slightly higher than the males. The rate for the six year period is only slightly, perhaps not significantly, lower than the 85% reported for the first three years in Part I.

Viewing the data for Elementary majors, the largest enrollments in the "regular" programs, IA and IB, show persistence rates comparable to the total population. The "special" programs designed to "up-grade" credentialed, non-degree teachers, IIA and IIB, and to prepare degree holders for certification, IIIA and IIIB, evidence much lower persistence rates. Though the numbers are smaller making the percentages less stable, it would be interesting, for example, to learn what factors contribute to making the percentage of IIIA male nonpersists (36%) twice that of the IA male nonpersists (17%). Certainly the regular program produced a more stable supply of male Elementary majors.

In the Secondary Academic fields, Table 2.7, the rates of persistence were lowest for Speech majors and highest for those in Speech Pathology. Notable is the fact that women in Mathematics and Natural Science were less likely to persist than those in other curriculums, except Speech. Though only three women were juniors in the Physical Science curriculum in six years, all three did persist.

The data for the Special Fields, Table 2.8, shows some interesting differences between the persistence rates of males and females. While men and women in Physical Education, though they are enrolled in different curriculums, are about equally likely to persist, it is the men in Art and the women in Business who are most likely to survive in their curriculums. These data substantiate the basic assumption of the research that considers curriculums separately. Males and females within curriculums should also be treated separately when possible.

Table 2.5

The Number and Percent of Male and Female Persists and Nonpersists in Elementary, Secondary, and Special Fields for the Six Year Period 1956-62

	Persists		Nonpersists		Total	
	N	%	N	%	N	%
Elementary						
Male	195	80	48	20	243	100
Female	1686	85	301	15	1987	100
Secondary						
Male	625	80	161	20	786	100
Female	591	82	130	18	721	100
Special Fields						
Male	526	84	102	16	628	100
Female	530	85	94	15	624	100
Total	4153	83	836	17	4989	100

Table 2.6

The Number and Percent of Male and Female Persists and Nonpersists in Elementary Education over the Six Year Period 1956-62

	Persists		Nonpersists		Total	
	N	%	N	%	N	%
Elementary IA						
Male	162	83	33	17	195	100
Female	1209	85	208	15	1417	100
Total	1371	85	241	15	1612	100
Elementary IIA						
Male	4	100	0	0	4	100
Female	72	85	13	15	85	100
Total	76	85	13	15	89	100
Elementary IIIA						
Male	27	64	15	36	42	100
Female	127	77	37	23	164	100
Total	154	75	52	25	206	100
Elementary IB						
Male	2	100	0	0	2	100
Female	244	89	31	11	277	100
Total	246	88	31	12	279	100
Elementary IIB						
Male	0	0	0	0	0	0
Female	6	60	4	40	10	100
Total	6	60	4	40	10	100
Elementary IIIB						
Male	0	0	0	0	0	0
Female	28	78	8	22	36	100
Total	28	78	8	22	36	100

Table 2.7

The Number and Percent of Male and Female Persists and Nonpersists in Secondary Academic Fields over the Six Year Period 1956-62

	Persists		Nonpersists		Total	
	N	%	N	%	N	%
Core						
Male	14	82	3	18	17	100
Female	18	86	3	14	21	100
Total	32	84	6	16	38	100
English						
Male	66	85	12	15	78	100
Female	176	83	35	17	211	100
Total	242	84	47	16	289	100
Foreign Languages						
Male	42	84	8	16	50	100
Female	107	88	15	12	122	100
Total	149	87	23	13	172	100
Language Arts						
Male	13	81	3	19	16	100
Female	35	83	7	17	42	100
Total	48	83	10	17	58	100
Mathematics						
Male	133	82	29	18	162	100
Female	35	74	12	26	47	100
Total	168	80	41	20	209	100
Natural Science						
Male	101	86	16	14	117	100
Female	25	71	10	29	35	100
Total	126	83	26	17	152	100
Physical Science						
Male	31	74	11	26	42	100
Female	3	100	0	0	3	100
Total	34	76	11	24	45	100
Social Science						
Male	176	73	64	27	240	100
Female	77	79	20	21	97	100
Total	253	75	84	25	337	100
Speech						
Male	33	70	14	30	47	100
Female	49	68	23	32	72	100
Total	82	69	37	31	119	100
Speech Pathology						
Male	16	94	1	6	17	100
Female	66	93	5	7	71	100
Total	82	93	6	7	88	100

Table 2.8

The Number and Percent of Male and Female Persists and Nonpersists in Special Fields over the Six Year Period 1956-62

	Persists		Nonpersists		Total	
	N	%	N	%	N	%
Art						
Male	50	86	8	14	58	100
Female	115	79	31	21	146	100
Total	165	81	39	19	204	100
Business						
Male	55	77	16	23	71	100
Female	47	87	7	13	54	100
Total	102	82	23	18	125	100
Industrial						
Male	158	90	18	10	176	100
Female	0	0	0	0	0	0
Total	158	90	18	10	176	100
Music						
Male	54	84	10	16	64	100
Female	69	84	13	16	82	100
Total	123	84	23	16	146	100
PEM						
Male	148	80	37	20	185	100
Female	0	0	0	0	0	0
Total	148	80	37	20	185	100
PEW						
Male	0	0	0	0	0	0
Female	105	81	24	19	129	100
Total	105	81	24	19	129	100
Recreation I						
Male	26	84	5	16	31	100
Female	33	87	5	13	38	100
Total	59	86	10	14	69	100
Recreation II						
Male	33	80	8	20	41	100
Female	16	76	5	14	21	100
Total	49	79	13	21	62	100
Nursing Education						
Male	2	100	0	0	2	100
Female	145	94	9	6	154	100
Total	147	94	9	6	156	100

The Data

The variables which were analyzed in this study are presented under five headings. The biographical variables identify information about the student which are a part of his history as a student. The psychometric variables are primarily the standardized tests administered as a part of the statewide testing program for Minnesota High Schools and as a part of the admission requirements of the College of Education. Although High School Rank is essentially a scaling of high school achievement, it is placed with psychometric variables because it is used as a basis for determining University admission. The academic variables are those which represent the quality of the student's achievement in his college curriculum. Achievement test data identifies those standardized tests which were used to obtain comparable measures of academic achievement. Experience data refers to information about the nature of post-bacculaurate experience. In the following sections, the definitions and the manner of collecting the data are presented. Since the variables described in the first three headings are the same as those used in the first three years of the study, the descriptions from the report of Part I are repeated here.

Biographical Data

Biographical items chosen for study were those which, with the exception of age, were concerned with previous educational experiences. These data were available from transcripts or applications for admission to the University.

School of Prior Registration. The purpose of this variable was to describe the type of school which the student attended prior to admission to the College of Education. A student may have come to the College from high school, from an off-campus college, or from one of the units of the University of Minnesota. If the student transferred to the College of Education from another institution, that college or university was classified as to whether it was a junior college, a state teachers' college, a Liberal Arts college, a technical school, or a professional school. Students transferring to the College of Education from an on-campus unit of the University were classified by the college from which they transferred.

Level of Prior Preparation. This item was devised so that students could be classified in terms of the number of college credits which they had completed at the time of entry into the College of Education, regardless of whether they came as a freshman or with advanced standing. For the student coming with previous college work, all credits earned prior to entry into the college were totaled and the student was classified as an advanced standing freshman (0-40 quarter credits), as a sophomore (41-85 quarter credits), as a junior (86-130 quarter credits), or as a senior (over 130 quarter credits). Students with previous degrees were considered as advanced standing seniors, because no more than 135 quarter credits can be transferred toward a degree.

The pattern of requirements for admission to each of the curriculums was presented in Part I. The purpose of this biographical item in the data collection was to permit a study of the credits completed at the time of admission into the curriculums as compared with the normal requirements for admission as specified in the College bulletin.

Size and Type of High School. To permit a description of the high school backgrounds of College of Education students, the high school which each College of Education student attended was classified by size and type. Seven categories were used for classification, six for those who attended Minnesota high schools and one for out-of-state schools. A graduate of a Minnesota high school was first classified according to whether he came from a public or private school, and then each school was further classified by enrollment as small, medium or large. Public schools with an enrollment of over 2,000 in the top three grades were classed as large; those with 1,000-2,000 in the tope three grades were classed as medium sized; and those whose enrollment was under 1,000 in the top three grades were labeled small. Categorization by size was made differently for the private schools. A private school was considered large if its enrollment in the top three grades was over 1,000, of medium size if the enrollment was between 450 and 1,000, and small if the enrollment was under 450. School enrollment data were obtained from the State Department of Education.

Size of Community. This variable was included to permit a study of the size of the community in which College of Education students attended high school. Although the size of the high school and the size of the community are certainly related, it was felt that there were important educational reasons to distinguish between urban, suburban, city, and town as the location of the high school. High schools in Minneapolis, St. Paul, or Duluth were labeled urban; and those adjacent to Minneapolis or St. Paul were classed as suburban. Cities were defined as those non-urban, non-suburban communities with more than 20,000 people. Towns were defined as those communities having between 10,000 and 20,000 people; and a separate category was used for those towns with less than 10,000 people. Because they were so few in number and classification was difficult, out-of-state residents were all classified together irrespective of community size. 1950 census figures were used to obtain population figures.

Age. The year of birth was recorded as reported on the University transcript. Before the variable was used in any computations, however, it was translated to the age in years at the time the student enrolled in the first professional sequence in Education.

Psychometric Data

High School Rank (HSR) High school percentile rank is most appropriately defined as a measure of high school achievement as indicated by the standing in the high school class. High school rank data are reported to colleges in Minnesota as a part of the information gathered during the state-wide testing program. It is commonly used as a predictor of college achievement, and its relation to other psychometric measures is always of interest. For these reasons, it is included under the heading of psychometric data in this study.

American Council on Education Psychological Examination (ACE). The ACE is commonly known, and was widely used as a measure of scholastic ability in high school and entering college students during the period of this study.

Miller Analogies Test (MAT). The MAT is a verbal analogies test designed to measure scholastic apticude; and during the period studied, was administered to all juniors in the College of Education before they took the first professional course in Education.

Cooperative Reading Test (Reading). This variable was defined as the scores made on Cooperative Reading Test, Form C2R, a standardized measure of reading comprehension.

Minnesota Teacher Attitude Inventory (MTAI). The MTAI is a widely used test of attitudes toward various aspects of teaching and activities related to it, and the variable used in this study was the score in this test made by juniors in the College of Education. As a convenience in the interpretation of scores, a constant of 500 is added to the raw score when it is reported. The scores used in this study had the constant added.

Minnesota Multiphasic Personality Inventory (MMPI). A standardized personality inventory which yields a profile of scores on ten clinical scales. Because the test is widely used, no further discussion of the scores is presented in this report.

Academic Data

The academic variables in this study were selected because they described several aspects of the quality of the student's academic performance either in the College of Education or prior to his admission.

Transfer Grade Point Average (Transfer GPA). This variable is defined as the grade point average earned by the student in college level courses taken before he entered the College of Education. The scale used was A = 4, B = 3, C = 2, D = 1, F = 0.

Ed 55-75 GPA. This grade point average, based on the same scale as the previous one, describes the quality of the work which a student did in the first professional course in the College of Education. Ed 55 and Ed 75 are the course numbers for the beginning courses for secondary and elementary majors. These courses have been described in an earlier chapter in this report.

Over-all GPA. This index was computed as an indication of the over-all quality of a student's work. It was determined at the end of spring quarter, 1959, and all those courses which the student had taken since he had been admitted to the College of Education were included in the computations.

Probation. This variable was used to describe the current and previous status combined of the student with regard to academic probation. Students were classified as to whether they had ever been on scholastic probation since being admitted to the University of Minnesota, whether they were placed on scholastic probation in the College of Education, and what their status was at the end of spring quarter, 1959. Students were placed in one of the five categories: 1) never on probation; 2) on probation in the College of Education, but made up honor points and was removed from probation; 3) on probation before entering the College of Education, but never on probation in Education; 4) on probation in Education and was dropped or withdrew while on probation; and 5) on probation and continuing as a student as of the end of spring quarter, 1959.

Achievement Test Data

The battery contains five achievement tests and was compiled for the

College of Education by Science Research Associates. The items are of the form designed by E. F. Lindquist and his associates for the family of achievement tests which includes the National Merit Scholarship Qualifying Test and the Iowa Tests of Educational Development. The five tests, the number of items in each, and the time limits are:

1)	English Usage	76 items	40 minutes
2)	Mathematics Usage	40 items	40 minutes
3)	Social Studies Reading	51 items	35 minutes
4)	Natural Science Reading	51 items	35 minutes
5)	Word Usage	88 items	20 minutes

The total test time for the batter is 2 hours and 50 minutes. A short description of the test battery follows.

English Usage. This test measures the student's educational development in understanding and using the basic elements in correct and effective writing: punctuation, usage, capitalization, diction, phraseology, and organization. The test consists of four written exercises with a number of errors or inappropriate expressions introduced. Most of the items are concerned with testing the general facility with the language, and a smaller percent with formal correctness. Thus, the test does not measure the student's ability to state formal rules, but rather his ability to put such knowledge to use.

Mathematics Usage. This test measures the student's educational development in using mathematical and arithmetical principles in the solution of practical quantitative problems and in the interpretation of graphs and charts. The test has two general kinds of problems: (1) quantitative reasoning drawn from realistic situations; (2) formal exercises drawn from geometry and first-year algebra. The first of these kinds of problems cover such topics as proportions and percentages and are drawn from a variety of areas such as industry, business and the social and natural sciences. The formal exercises include such problems as solving first-degree equations in one and two unknowns, working with roots and powers, and factoring quadratics.

Social Studies Reading. This test measures the student's educational development in the ability to interpret and evaluate reading selections in the social studies. Typical passages are concerned with topics and problems that clearly lie in such areas as economics, history, and psychology. Test questions relating to the passages require both a clear comprehension of the reading material and an integration of relatively new ideas with background principles. The questions emphasize broad interpretations and call for the integration of a number of elements in the passage. General skills tested include recognizing the author's biases, distinguishing between facts and opinions, and detecting the techniques of the demogogue and recognizing false or specious reasoning.

Natural Sciences Reading. This test is cast in the same form as the social studies reading test and measures the student's educational development in the ability to interpret and evaluate reading materials in the natural sciences. Although it has a surface resemblance to a reading comprehension test, it was actually designed to draw heavily upon the student's science background as upon his ability to comprehend the content of the reading passages. The test questions were prepared to assess the student's understanding of the methods of science, the nature of experimentation, and the steps followed in arriving at conclusion and generalizations.

Word Usage. This test directly measures the student's ability to recognize word meaning. The words are presented in context rather than as isolated works.

Experience Data

One aspect of this study was designed to describe the retention of graduates of teacher education programs in the teaching profession. The experience data was collected by follow-up questionnaires. Each graduating class was composed of those graduating during the school year beginning the first summer session in June and ending the close of the spring quarter a year later. Each year, beginning in 1960, a questionnaire was sent to members of the classes which had graduated. Questionnaires were designed to ascertain whether the graduate was teaching or not. Based on the replies for a given year, the members of each class could be classified as belonging to one of the three following groups:

(a) those who reported they were teaching
(b) those who reported they were not teaching
(c) those who did not respond and who may or may not have been teaching

After the initial follow-up, class members were questioned annually to see if they were teaching; and in addition, each new graduating class was sent an original inquiry. From this procedure each member of each class was re-classified each succeeding year. Table 2.9 summarizes the information available for each graduating class.

Table 2.9

Experience data available from five graduating classes.

Year after Graduation	Graduating Class 1958*	1959	1960	1961
1st	x	x	x	x
2nd	x	x	x	x
3rd	x	x	x	x
4th	x	x	x	

*1958 refers to those graduating during 1957-58

The table indicates that data from four graduating classes are available to describe the status of graduates three years after graduation, and three classes have been followed for four years beyond graduation.

The Central Questions

The basic purpose of this study as stated in Chapter I is to describe students in teacher education in such a way that factors associated with their selective retention could be identified. The contract specified that data in four different categories would be collected and analyzed toward this end. The previous section has identified these classes of data as biographical, psychometric and academic data, and tests of educational development. This section presents the more detailed questions of the study framed to forecast the structure of the remainder of the report.

General Descriptions of Entering Juniors

In the analysis of data in Part I of this longitudinal study, three classes of junior women in Elementary Education were compared on biographical and psychometric data. The differences among the three entering groups was not judged to be of a practical significance, and this judgment was supported by our review of data from the total of six classes. The analyses of each major field in Part II consider the six classes as one group as a result of our judgment of the lack of practical differences among the individual classes. Chapter III presents the univariate descriptions for the males and/or females in each major field for which there were sufficient numbers for analysis. For convenience of presentation, the majors are grouped into Elementary, Secondary, and Special Fields. The presentation consists of simple percentage data and measures of central tendency and variability. Part I established the reality of differences among students in four majors, so for purposes of this report, the important differences are evident by using the "eye test". The central question for Chapter III is: What are the characteristics of juniors entering the College of Education in terms of the designated biographical, psychometric and academic variables?

Comparisons of Persists and Nonpersists

Even though the analyses presented in Part I did not find consistent differences among persistence criterion groups, this report did pursue the question with larger samples and analyses of students in other major fields. It did seem to be important to consider further this central question in Chapter IV: Are there differences between those who persist in a major field and those who do not?

Comparisons of Men and Women in the Same Curriculum

The population of students studied in Part I did not permit a study of the differences between male and female juniors in the same curriculum. Comparisons were made among four groups, two groups of men and two of women, but all were in different major fields. Though such comparisons were helpful, they could not answer the central question considered in Chapter V: Are there differences between the male and female juniors who persist the same major field?

Educational Development of Students in Five Majors

The "new" phase of the longitudinal study which was included in this part was concerned with measures of educational development. The achievement tests described above were administered to answer three central questions.

How do students in different teacher education majors compare on standardized measures of educational development?

How do persists and nonpersists compare on measures of educational development?

Is there growth in educational development from the beginning of the junior year to the end of the senior year?

These three are the central questions for Chapters VI, VII, and VIII.

Comparisons of MMPI Test Results

To supplement the general comparisons of students, a more detailed analysis of the MMPI test was made for men and women in five curriculums. Current research literature does not present detailed data on the MMPI. The usual practice is to group all teacher education majors together assuming that the common interest in teaching justifies the grouping. Chapter IX presents basic normative data on MMPI scores for men and women, five teachers education curriculum, to answer the central question: How do the MMPI scores differ among juniors in different teacher education majors?

Teaching After Graduation

A question, about which there is a great deal of speculation among those interested in preparing teachers, forms the central question for Chapter X.

What proportion of graduates enter teaching and where do they go to teach?

The eight central questions, which are contained in the sections above, are the focus for the eight chapters which follow.

Chapter III

Univariate Description of Selected Majors

Majors in Five Elementary Education Curriculums

Biographical Data

Five biographical variables are anlayzed for the five elementary education curriculums in Tables 3.1 through 3.5.

Of the women who entered the IA curriculum, the general Elementary curriculum, about one-fourth came directly from high school. The three-fourths who transferred from other colleges came about equally from off-campus institutions and on-campus colleges. Nearly all of those transferring from on-campus came from the College of Liberal Arts. The patterns for women in the IB curriculum, the Nursery, Kindergarten, Primary curriculum, was similar to that for the women in IA except a somewhat larger number came directly from high school and somewhat fewer from off-campus. In contrast, four-fifths of the men in the IA curriculum came from on-campus colleges with the remainder coming from off-campus instititutions (13%) and directly from high schools (5.7%). Those women who had teaching certificates and were seeking a degree credential (IIA) were nearly all (96.5%) previously registered in off-campus instititutions while college graduates seeking initial certification (IIIA) about equally often came from off-campus and on-campus colleges.

The level of preparation completed prior to entering the Elementary curriculum is presented in Table 3.2. The figures that are of primary interest in this table is the contrast between the men and women in the IA curriculum. Over two-thirds (69.7%) of the men had completed at least two years of transferable college work while less than half (44.2%) of the women came with an equal number of advanced standing credits. Other contrasts in the table are primarily a result of the point of entry permitted by the IIA and IIIA curriculums.

Tables 3.3 and 3.4 present data on the high schools from which the Elementary Education majors graduated and the type of community in which the high school was located. A comparison of the IA and IB curriculums finds a similar pattern. Few of these majors, men or women, came from communities of less than 20,000 and high schools enrolling less than 1000 students. Large urban and suburban high schools were attended by over 60% of those in these two curriculums. It is interesting to note that men in the IA curriculum are much less likely to have attended suburban high schools (3.6%) than the women (11.4%).

Further differences between men and women in the IA curriculum is noted in the ages of the two groups at the time they took the first professional sequence. Age data in Table 3.5 shows that three-fourths of the women were under 21 years of age while four-fifths of the men were 21 or older, and about half of that number (40.9%) were over 24 years of age. In contrast, only 28.2% of the women in the IA curriculum were over 24 years old. The women in the IB curriculum showed an age distribution similar to women in the IA curriculum.

Table 3.1 - School of Prior Registration for Male Students in One Curriculum and Female Students in Five Elementary Education Curriculums

Major	High School		Off Campus		On Campus						Total	
					CLA		GC		Other			
	f	%	f	%	f	%	f	%	f	%	f	%
Elem. IA												
Male	11	5.7	25	13.0	95	49.2	53	27.5	9	4.6	193	100
Female	338	24.0	539	38.3	453	32.2	37	2.6	40	2.9	1407	100
Elem. IIA												
Female	0	0.0	82	96.5	3	3.5	0	0.0	0	0.0	85	100
Elem. IIIA												
Female	0	0.0	72	45.3	56	35.2	0	0.0	31	19.5	159	100
Elem. IB												
Female	104	38.0	81	29.6	65	23.7	14	5.1	10	3.7	274	100
Elem. IIIB												
Female	0	0.0	14	40.0	14	40.0	0	0.0	7	20.0	35	100

Table 3.2 - Level of Prior Preparation for Male and Female Students in Five Elementary Education Curriculums

Major	High School		Freshman		Sophomore		Advanced Standing				Total	
							Junior		Senior			
	f	%	f	%	f	%	f	%	f	%	f	%
Elem. IA												
Male	10	5.2	4	2.1	45	23.3	113	58.6	21	10.9	193	100
Female	340	24.1	71	5.0	375	26.6	552	39.2	71	5.0	1409	100
Elem. IIA												
Female	0	0.0	0	0.0	5	5.9	44	51.8	36	42.4	85	100
Elem. IIIA												
Female	0	0.0	2	1.2	2	1.2	3	1.9	155	95.7	162	100
Elem. IB												
Female	102	37.1	13	4.7	81	29.5	70	25.5	9	3.3	275	100
Elem. IIIB												
Female	0	0.0	0	0.0	1	2.7	0	0.0	36	97.3	37	100

Table 3.3 - Size and Type of High School from Which Male and Female Students in Five Elementary Education Curriculums Graduated

Major	Public						Private		Other		Total	
	<1000		1000-2000		> 2000							
	f	%	f	%	f	%	f	%	f	%	f	%
Elem. IA												
Male	46	23.8	21	10.9	110	57.0	2	1.0	14	7.3	193	100
Female	316	22.4	175	12.4	746	53.0	26	1.9	146	10.4	1409	100
Elem. IIA												
Female	47	55.3	9	10.6	8	9.4	2	2.4	19	22.4	85	100
Elem. IIIA												
Female	33	20.4	10	6.2	81	50.0	1	0.6	37	22.8	162	100
Elem. IB												
Female	50	18.2	34	12.4	169	61.5	4	1.5	18	6.6	275	100
Elem. IIIB												
Female	7	18.9	6	16.2	13	35.1	1	2.7	10	27.0	37	100

Table 3.4 - Size Community in Which the High School Was Located for Male and Female Students in Five Elementary Education Curriculums

Major	Urban		Suburban		<10,000		10-20,000		>20,000		Out of State		Total	
	f	%	f	%	f	%	f	%	f	%	f	%	f	%
Elem. IA														
Male	109	56.5	7	3.6	47	24.4	11	5.7	5	2.6	14	7.3	193	100
Female	647	46.0	160	11.4	366	26.0	49	3.5	38	2.7	147	10.5	1407	100
Elem. IIA Female	10	11.8	1	1.2	48	56.5	4	4.7	2	2.4	20	23.5	85	100
Elem. IIIA Female	79	48.8	8	4.9	29	17.9	3	1.9	5	3.1	38	23.5	162	100
Elem. IB Female	152	55.3	32	11.6	57	20.7	10	3.6	6	2.2	18	6.6	275	100
Elem. IIIB Female	3	30.0	1	10.0	4	40.0	0	0.0	0	0.0	2	20.0	10	100

Table 3.5 - Age at Entrance to the Junior Sequence for Male and Female Students in Five Elementary Education Curriculums

Major	< 20		20		21		22		23		24		> 24		Total	
	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%
Elem. IA																
Male	1	.5	37	19.2	17	8.8	18	9.3	18	9.3	23	11.9	79	40.9	193	100
Female	178	12.6	873	62.0	154	10.9	44	3.1	22	1.6	22	1.6	116	8.2	1409	100
Elem. IIA																
Female	2	2.4	1	1.2	3	3.5	5	5.9	4	4.7	2	2.4	68	80.0	85	100
Elem. IIIA																
Female	0	0.0	2	1.2	13	8.0	23	14.2	14	8.6	10	6.2	100	61.7	162	100
Elem. IB																
Female	34	12.4	188	68.4	28	10.2	6	2.2	4	1.5	1	0.4	14	5.1	275	100
Elem. IIIB																
Female	0	0.0	2	5.4	2	5.4	5	13.5	5	13.5	3	8.1	20	54.1	37	100

Psychometric Data

Means and standard deviations of the six psychometric variables for the Elementary majors are presented in Table 3.6. High school rank (HSR), Minnesota Scholastic Aptitude Test (MSAT) and Cooperative English Test (Eng.) scores are typically obtained through the statewide testing programs for Minnesota high schools. The other three tests, Miller Analogies Tests (MAT), Cooperative Reading (Rdng.) and Minnesota Teacher Attitude Inventory (MTAI), are given as a part of the requirements for admission to the junior year. Three points are noteworthy. Men in the IA curriculum have lower HSR, MSAT, and Eng. scores than women in the same field, but the scores from the battery of tests at the junior level show no differences. Any inclination to infer that men are less able than the women on the basis of MSAT scores does not seem warranted on the basis of MAT scores. Second, women in the IIA curriculum scored highest on all measures except MTAI, and third, the highest MTAI average was for the group who were teachers-in-service completing degree requirements. Tables 3.7 through 3.12 present the cumulative frequency distribution for the psychometric variables.

Achievement Data

Table 3.13 presents achievement data which summarizes performance at the time of entrance into the College (transfer GPA) and three indexes of performance while in the College, overall GPA, Junior Sequence GPA, and Student Teaching GPA. Women in the IIIA clearly achieved the highest in all four GPA's, as well as high school, HSR, (Table 3.6). Though the men in the IA field did less well than the women in either IA or IB prior to admission, the differences had largely disappeared when achievement in the College is compared. Tables 3.14 through 3.17 give more detailed distributions of the academic variables.

Majors in Eight Secondary Education Curriculums

Biographical Data

The schools of prior registration are presented in Table 3.18 for eight Secondary Education fields. The isolated cases of those who came to the College of Education from high school are those who were admitted into four-year programs and subsequently transferred into two-year programs requiring junior status for admission. Typically, about one-fourth of the majors in these Secondary Education fields transferred from off-campus and another two-thirds came from the College of Liberal Arts. Five groups, however, showed a different pattern. For the women in Foreign Language Education and the men in Speech Education, five out of six came from CLA and only 15% from off-campus. Three groups of men, Mathematics, Natural Science, Physical Science, showed a different pattern because of the larger percentages coming from "Other" on-campus colleges -- principally, the Institute of Technology.

Table 3.19 shows that little variation occurs from the typical pattern of entry into these Secondary fields at the junior level. The deviations are shown in the extent to which students transferred with enough advanced credits to be classed as seniors. This larger proportion of seniors was found for both men and women in Natural Science and men in English, Foreign Language, and Physical Science.

Table 3.6 - Means and Standard Deviations of Six Psychometric Variables for Male and Female Students in Five Elementary Education Curriculums

Major	HSR		MSAT		Eng		MAT		Rdng		MTAI	
	$\bar{x}$	sd	$\bar{x}$	sd	$\bar{x}$	sd	$\bar{x}$	sd	$\bar{x}$	sd	$\bar{x}$	sd
Elem. IA												
Male	53.5	28.1	45.2	30.3	39.4	30.2	60.3	10.6	78.4	29.0	534.2	27.4
Female	79.1	19.6	63.3	23.2	67.3	23.0	60.7	10.2	76.8	29.0	535.3	36.7
Elem. IIA												
Female	77.0	17.8	--	--	45.2	29.1	56.5	11.8	72.1	31.5	550.2	30.9
Elem. IIIA												
Female	81.7	17.6	--	--	74.7	21.4	68.7	10.4	103.9	30.7	538.8	44.0
Elem. IB												
Female	76.7	19.1	56.3	26.9	63.4	25.3	58.8	10.3	70.9	26.4	539.2	31.1

Table 3.7

Selected Percentile Points from the Cumulative Percentage Distributions of High School Rank (HSR) for Male and Female Students in Five Elementary Education Curriculums

Major	HSR Percentiles						
	5	25	40	50	60	75	95
Elem. IA							
Male	7.2	29.8	45.8	55.8	65.2	77.1	93.8
Female	42.6	69.8	79.1	83.4	87.5	92.8	99.3
Elem. IIA							
Female	47.2	64.8	76.6	80.0	86.3	91.4	99.7
Elem. IIIA							
Female	41.8	74.0	84.8	87.5	90.6	95.4	99.7
Elem. IB							
Female	39.1	66.1	77.3	82.6	86.4	91.9	97.6

Table 3.8

Selected Percentile Points from the Cumulative Percentage Distributions of Minnesota Scholastic Aptitude Test (MSAT) for Male and Female Students in Five Elementary Education Curriculums

Major	MSAT Percentiles						
	5	25	40	50	60	75	95
Elem. IA							
Male	8.1	16.4	26.9	44.0	59.1	60.1	94.0
Female	21.3	47.8	56.4	66.2	73.8	83.9	94.9
Elem. IIA							
Female	--	--	--	--	--	--	--
Elem. IIIA							
Female	--	--	--	--	--	--	--
Elem. IB							
Female	5.3	32.5	44.3	51.0	72.3	81.5	91.1

Table 3.9

Selected Percentile Points from the Cumulative Percentage Distributions of Co-op English Test (Eng) for Male and Female Students in Five Elementary Education Curriculums

Major	Eng Percentile						
	5	25	40	50	60	75	95
Elem. IA							
Male	1.1	11.0	23.0	31.3	45.5	70.7	85.3
Female	18.8	55.5	68.2	73.2	81.4	84.2	93.2
Elem. IIA							
Female	5.6	17.5	35.7	43.5	56.3	66.5	86.1
Elem. IIIA							
Female	29.7	60.5	78.0	82.7	84.4	91.0	98.0
Elem. IB							
Female	14.4	44.8	65.4	72.2	77.3	83.0	92.5

Table 3.10

Selected Percentile Points from the Cumulative Percentage Distributions of Miller Analogies Test (MAT) for Male and Female Students in Five Elementary Education Curriculums

Major	MAT Percentiles						
	5	25	40	50	60	75	95
Elem. IA							
Male	40.4	52.9	57.5	61.0	63.8	68.1	77.3
Female	43.1	53.8	58.1	60.8	63.5	67.8	77.3
Elem. IIA							
Female	33.6	47.7	54.6	56.7	59.6	65.0	77.4
Elem. IIIA							
Female	50.5	62.5	66.2	68.5	71.5	75.4	86.0
Elem. IB							
Female	41.6	52.4	56.5	59.5	61.7	65.6	75.4

Table 3.11

Selected Percentile Points from the Cumulative Percentage Distributions of Co-op Reading Test (Rdng) for Male and Female Students in Five Elementary Education Curriculums

Major	Rdng Percentiles						
	5	25	40	50	60	75	95
Elem. IA							
Male	33.3	57.7	67.5	73.9	82.9	97.1	130.8
Female	33.5	55.6	67.8	76.0	82.8	95.2	126.4
Elem. IIA							
Female	22.7	53.5	62.4	70.5	80.9	88.3	116.3
Elem. IIIA							
Female	58.4	84.9	95.4	101.2	107.4	120.2	166.6
Elem. IB							
Female	34.3	52.4	64.0	69.8	75.5	85.8	111.1

Table 3.12

Selected Percentile Points from the Cumulative Percentage Distributions of Minnesota Teacher Attitude Test (MTAT) for Male and Female Students in Five Elementary Education Curriculums

Major	MTAT Percentiles						
	5	25	40	50	60	75	95
Elem. IA							
Male	491.2	514.2	526.2	532.9	542.7	552.1	580.7
Female	485.2	517.4	530.2	537.0	545.2	557.0	581.1
Elem. IIA							
Female	502.7	525.5	543.7	550.5	558.7	570.0	599.1
Elem. IIIA							
Female	480.6	522.6	534.3	542.3	550.2	561.7	587.5
Elem. IB							
Female	484.0	519.0	533.6	542.6	547.2	562.2	587.9

Table 3.13

Means and Standard Deviations of Four Academic Variables for Male and Female Students in Five Elementary Education Curriculums

Major	Transfer GPA		Overall GPA		Jr. Sequence GPA		St. Teach. GPA	
	$\bar{x}$	sd	$\bar{x}$	sd	$\bar{x}$	sd	$\bar{x}$	sd
Elem. IA								
Male	2.29	.45	2.51	.44	2.36	.78	3.11	.61
Female	2.52	.45	2.62	.46	2.46	.76	3.16	.56
Elem. IIA								
Female	2.89	.49	2.76	.45	2.64	.72	2.48	.62
Elem. IIIA								
Female	2.81	.55	3.12	.57	3.21	.84	3.32	.52
Elem. IB								
Female	2.47	.48	2.61	.43	2.37	.79	3.19	.54

Table 3.14

Selected Percentile Points from the Cumulative Percentage Distributions of Transfer Grade Point Average for Male and Female Students in Five Elementary Education Curriculums

Major	Percentile 5	25	40	50	60	75	95
Elem. IA							
Male	1.74	2.02	2.12	2.19	2.29	2.49	3.09
Female	1.96	2.19	2.32	2.42	2.54	2.81	3.39
Elem. IIA							
Female	2.21	2.51	2.72	2.89	2.99	3.23	3.68
Elem. IIIA							
Female	1.99	2.44	2.63	2.83	2.90	3.19	3.86
Elem. IB							
Female	1.93	2.12	2.26	2.38	2.51	2.79	3.31

Table 3.15

Selected Percentile Points from the Cumulative Percentage Distributions of Junior Sequence Grade Point Average for Male and Female Students in Five Elementary Education Curriculums

Major	Percentile 5	25	40	50	60	75	95
Elem. IA							
Male	.99	1.98	1.99	2.00	2.50	2.97	3.98
Female	.97	1.98	2.00	2.49	2.51	2.98	3.98
Elem. IIA							
Female	.53	2.27	2.51	2.73	2.98	2.99	3.57
Elem. IIIA							
Female	1.50	2.50	3.00	3.50	3.52	3.98	4.00
Elem. IB							
Female	1.00	1.97	1.99	2.00	2.50	2.97	3.98

Table 3.16

Selected Percentile Points from the Cumulative Percentage Distributions of Overall Grade Point Average for Male and Female Students in Five Elementary Education Curriculums

Major	Percentile 5	25	40	50	60	75	95
Elem. IA							
Male	1.83	2.26	2.41	2.51	2.62	2.84	3.17
Female	1.92	2.33	2.49	2.59	2.68	2.88	3.43
Elem. IIA							
Female	2.05	2.57	2.67	2.77	2.86	3.01	3.52
Elem. IIIA							
Female	1.94	2.80	3.09	3.24	3.32	3.53	3.85
Elem. IB							
Female	1.98	2.31	2.46	2.55	2.67	2.89	3.41

Table 3.17

Selected Percentile Points from the Cumulative Percentage Distributions of Student Teaching Grade Point Average for Male and Female Students in Five Elementary Education Curriculums

Major	Percentile 5	25	40	50	60	75	95
Elem. IA							
Male	1.98	2.67	2.98	3.00	3.49	3.51	3.99
Female	2.00	2.97	2.99	3.00	3.49	3.51	3.99
Elem. IIA							
Female	.99	1.99	2.52	2.57	2.97	2.98	3.00
Elem. IIIA							
Female	2.50	2.98	3.00	3.49	3.51	3.52	4.00
Elem. IB							
Female	2.29	2.97	2.99	3.11	3.32	3.63	3.99

Table 3.18 - School of Prior Registration for Male and Female Students in Eight Secondary Education Curriculums

Major	High School		Off Campus		On Campus						Total	
					CLA		GC		Other			
	f	%	f	%	f	%	f	%	f	%	f	%
English												
Male	0	0.0	21	27.6	52	68.4	0	0.0	3	4.0	76	100.0
Female	2	1.0	56	26.9	145	69.7	0	0.0	5	2.4	208	100.0
For. Lang.												
Male	0	0.0	12	25.0	33	68.7	0	0.0	3	6.3	48	100.0
Female	0	0.0	18	15.1	100	83.3	0	0.0	2	1.7	120	100.0
Math												
Male	0	0.0	19	11.9	91	56.9	1	0.6	49	30.6	160	100.0
Female	0	0.0	13	27.7	29	61.7	0	0.0	5	10.6	47	100.0
Nat. Sci.												
Male	0	0.0	18	15.9	66	58.4	5	4.4	24	21.3	113	100.0
Female	0	0.0	15	42.8	17	48.6	0	0.0	3	8.6	35	100.0
Phy. Sci.												
Male	0	0.0	0	0.0	17	41.5	1	2.4	23	56.1	41	100.0
Soc. St.												
Male	2	.9	28	12.0	185	79.0	9	3.9	10	4.3	234	100.0
Female	0	0.0	26	27.7	64	68.1	1	1.0	3	3.2	94	100.0
Speech												
Male	0	0.0	5	10.6	39	83.0	2	4.3	1	2.1	47	100.0
Female	0	0.0	19	26.4	47	65.2	3	4.2	3	4.2	72	100.0
Speech Path.												
Female	2	2.7	20	28.0	48	67.5	1	1.3	0	1.3	71	100.0

Table 3.19 - Level of Prior Preparation for Male and Female Students in Eight Secondary Education Curriculums

Major	High School		Freshman		Sophomore		Advanced Standing				Total	
							Junior		Senior			
	f	%	f	%	f	%	f	%	f	%	f	%
English												
Male	0	0.0	0	0.0	5	6.6	47	61.8	24	31.6	76	100.0
Female	2	1.0	0	0.0	17	8.2	154	74.4	34	16.4	207	100.0
For. Lang.												
Male	0	0.0	0	0.0	2	4.0	24	48.0	24	48.0	50	100.0
Female	0	0.0	0	0.0	8	6.7	90	75.0	22	18.3	120	100.0
Math												
Male	1	.63	0	0.0	5	3.1	123	76.9	31	19.4	160	100.0
Female	0	0.0	0	0.0	2	4.2	38	80.9	7	14.9	47	100.0
Nat. Sci.												
Male	0	0.0	0	0.0	3	2.6	81	70.4	31	27.0	115	100.0
Female	0	0.0	0	0.0	1	2.9	23	65.7	11	31.4	35	100.0
Phy. Sci.												
Male	0	0.0	0	0.0	4	9.8	17	41.4	20	48.8	41	100.0
Soc. St.												
Male	5	2.1	2	.9	20	8.5	154	65.3	55	23.3	236	100.0
Female	0	0.0	0	0.0	5	5.3	69	72.6	21	22.1	95	100.0
Speech												
Male	0	0.0	1	2.1	2	4.3	32	68.1	12	25.5	47	100.0
Female	0	0.0	1	1.4	7	9.7	57	79.2	7	9.7	72	100.0
Speech Path.												
Female	3	4.2	0	0.0	4	5.7	61	85.9	3	4.2	71	100.0

In all eight fields the percentage of men and women who come from large public high schools and those whose high schools were in urban communities range from one-third to one-half. Some exceptions can be noted in Table 3.20. Women in Foreign Language Education and Social Studies Education come more frequently from large high schools and less frequently from schools of less than a thousand enrollment. Mathematics and Natural Science Education had the largest percentage from small high schools and small communities.

Though the junior in Secondary Education fields is typically 20 years of age, the age distribution presented in Table 3.21 does differ among the fields. The women in Mathematics, Speech, and Speech Pathology tend to be younger, about 75% of them younger than 21 years of age. The men in English, Foreign Language, Natural Science, and Speech tend to be older as do the women in Natural Science for 28% to 40% of them are over 24 years of age.

Psychometric Data

Tables 3.23 through 3.29 present mean, standard deviations and percentile distributions for the six psychometric variables. Because of the general uniformity of the pattern of scores they are presented without discussion.

Academic Data

Table 3.30 presents the summary statitistics and Tables 3.31 through 3.34 provide the cumulative percentile distributions for the four grade point average variables. These data require little comment. The differences among majors do not seem noteworthy. Women in each major field almost invariably do better than men in the same field, but the differences seem unimportant.

Majors in Five Special Fields Curriculums

Biographical Data

During the period of the study the Special Fields Curriculums designated the freshman year as the point of entry into the programs. Table 3.35 shows, however, that entry directly from high school certainly was not typical, the percentage varied from 46.4% for women Physical Education majors to 1.5% of the men in Business. Art majors came in largest numbers, about 50% from CLA, and of the remainder a large number of the men transferred from General College (25%) and a sizeable group of the women came from off-campus (22.5%). Less than 30% of the Business majors came from CLA and those transferring from other institutions show differences between the men and the women. Over half the women come from off-campus, but just over one-fourth of the men are in the off-campus category. Men in Business Education more often transfer from on-campus, a large percentage (36.2%) coming from "Other" which, in this case, is largely from the School of Business. Men in Industrial Education came in nearly equal proportions from each of the five categories of schools of prior registration. More than a third of the Music Education majors came from CLA, and more women from off-campus and more men from high school. Men admitted to Physical Education were well distributed among the transfer schools, but differing from other majors in the larger proportion from GC (27.3%) and from High School (30.6%). Women in Physical Education came in larges numbers from High School or off-campus with only about one-fourth coming from all on-campus schools.

Table 3.20 - Size and Type of High School Attended for Male and Female Students in Eight Secondary Education Curriculums

Major	Public						Private		Other		Total	
	>1000		1000-2000		<2000							
	f	%	f	%	f	%	f	%	f	%	f	%
English												
Male	19	25.0	5	6.6	27	35.5	10	13.2	15	19.7	76	100.0
Female	55	26.4	28	13.5	85	40.9	7	3.3	33	15.9	208	100.0
For. Lang.												
Male	14	28.0	6	12.0	19	38.0	1	2.0	10	20.0	50	100.0
Female	15	12.5	14	11.6	64	53.2	6	5.0	21	17.7	120	100.0
Math												
Male	57	35.6	19	11.9	67	41.9	6	3.7	11	6.9	160	100.0
Female	17	36.2	6	12.8	19	40.3	0	0.0	5	10.6	47	100.0
Nat. Sci.												
Male	39	33.9	12	10.4	45	39.1	5	4.4	14	12.2	115	100.0
Female	15	42.9	6	17.1	9	25.7	1	2.9	4	11.4	35	100.0
Phy. Sci.												
Male	11	26.8	6	14.6	20	48.8	1	2.5	3	7.3	41	100.0
Soc. St.												
Male	48	20.1	27	11.2	127	53.6	12	6.0	22	9.1	236	100.0
Female	11	11.6	11	11.6	45	47.3	7	7.4	21	22.1	95	100.0
Speech												
Male	11	23.4	4	8.5	26	55.3	2	4.3	4	8.5	47	100.0
Female	23	31.9	6	8.3	24	33.3	5	7.0	14	19.5	72	100.0
Speech Path.												
Female	22	31.0	6	8.4	34	47.9	0	0.0	9	12.7	71	100.0

Table 3.21 - Size of High School Community for Male and Female Students in Eight Secondary Education Curriculums

Major	Urban		Suburban		>10,000		10-20,000		<20,000		Out of State		Total	
	f	%	f	%	f	%	f	%	f	%	f	%	f	%
English														
Male	32	42.1	2	2.6	23	30.3	2	2.6	2	2.6	15	19.8	76	100.0
Female	76	36.5	12	5.8	71	34.1	9	4.3	7	3.4	33	15.9	208	100.0
For. Lang.														
Male	17	34.0	1	2.0	18	36.0	2	4.0	2	4.0	10	20.0	50	100.0
Female	53	44.2	16	13.4	25	20.8	1	.8	4	3.3	21	17.5	120	100.0
Math														
Male	57	35.6	13	8.1	71	44.4	5	3.1	3	1.9	11	6.9	160	100.0
Female	17	36.2	4	8.5	20	42.6	1	2.1	0	0.0	5	10.6	47	100.0
Nat. Sci.														
Male	42	36.5	3	2.6	43	37.4	11	9.6	2	1.7	14	12.2	115	100.0
Female	10	28.5	0	0.0	19	54.3	1	2.9	1	2.9	4	11.4	35	100.0
Phy. Sci.														
Male	18	43.9	0	0.0	16	39.0	2	4.9	2	4.9	3	7.3	41	100.0
Soc. St.														
Male	115	48.9	20	8.5	60	25.6	10	4.3	9	3.8	21	8.9	235	100.0
Female	41	43.2	6	6.3	14	14.7	6	6.3	7	7.4	21	22.1	95	100.0
Speech														
Male	22	46.8	4	8.5	15	31.9	2	4.3	0	0.0	4	8.5	47	100.0
Female	21	29.2	3	4.2	28	38.5	2	2.9	4	5.7	14	19.5	72	100.0
Speech Path.														
Female	29	40.9	4	5.6	25	35.2	3	4.2	1	1.4	9	12.7	71	100.0

Table 3.22 - Age at Entrance to Junior Year for Male and Female Students in Eight Secondary Education Curriculums

Major	< 20		20		21		22		23		24		> 24		Total	
	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%
English																
Male	4	5.3	36	34.2	6	7.8	7	9.2	4	5.3	6	7.9	16	30.3	76	100.0
Female	24	11.5	120	57.7	21	10.1	13	6.3	3	1.4	4	1.9	23	11.1	208	100.0
For. Lang.																
Male	0	0.0	11	22.0	8	16.0	3	6.0	5	10.0	3	6.0	20	40.0	50	100.0
Female	9	7.5	70	58.3	18	15.0	8	6.7	0	0.0	0	0.0	15	12.5	120	100.0
Math																
Male	6	3.8	61	38.1	30	18.8	8	5.0	16	10.0	14	8.7	25	15.6	160	100.0
Female	3	6.4	33	70.2	7	14.9	1	2.1	0	0.0	1	2.1	2	4.3	47	100.0
Nat. Sci.																
Male	2	1.4	36	31.3	17	14.8	8	7.0	11	9.6	9	7.8	32	27.8	115	100.0
Female	4	11.4	13	37.1	5	14.3	1	2.9	2	5.7	0	0.0	10	28.6	35	100.0
Phy. Sci.																
Male	0	0.0	10	24.4	13	31.7	6	14.6	3	7.3	2	4.9	7	17.1	41	100.0
Soc. St.																
Male	4	1.7	82	34.8	30	12.7	16	6.8	26	11.0	27	11.4	51	21.6	236	100.0
Female	9	9.5	51	53.7	10	10.5	5	5.3	1	1.1	3	3.1	16	16.8	95	100.0
Speech																
Male	1	2.1	12	25.5	9	19.2	1	2.1	4	8.5	6	12.8	14	29.8	47	100.0
Female	11	15.3	43	59.7	12	16.6	2	2.8	0	0.0	1	1.4	3	4.2	72	100.0
Speech Path.																
Female	5	7.1	51	71.8	7	9.9	3	4.2	0	0.0	1	1.4	4	5.6	71	100.0

Table 3.23 - Means and Standard Deviations of Six Psychometric Variables for Male and Female Students in Eight Curriculums in Secondary Education

Major	HRS		MSAT		Eng		MAT		Rdng		MTAT	
	$\bar{x}$	sd	$\bar{x}$	sd	$\bar{x}$	sd	$\bar{x}$	sd	$\bar{x}$	sd	$\bar{x}$	sd
English												
Male	77.5	17.5	77.1	13.1	70.8	21.5	70.9	10.1	110.3	27.7	528.9	25.7
Female	89.5	10.5	88.8	12.8	82.6	14.7	70.0	9.5	113.1	29.1	532.6	28.6
For. Lang.												
Male	68.4	23.3	74.7	25.5	53.1	29.1	63.7	12.2	86.9	35.9	516.8	29.2
Female	88.3	12.5	80.2	20.2	76.8	22.3	66.7	11.2	91.7	28.1	527.3	30.3
Math												
Male	81.7	18.9	79.8	15.9	62.0	26.0	69.3	9.6	86.4	28.5	511.8	27.1
Female	95.4	4.4	90.3	12.4	82.0	17.5	70.2	9.1	95.6	27.2	528.4	25.8
Nat. Sci.												
Male	71.8	21.8	77.8	17.9	51.7	29.3	68.5	9.7	91.0	33.4	519.8	28.6
Female	91.3	7.8	66.0	0.0	74.4	14.5	69.1	8.5	96.0	32.4	520.3	31.4
Phy. Sci.												
Male	81.2	19.2	76.0	25.5	64.9	24.9	72.2	10.6	95.1	31.4	514.4	27.2
Soc. St.												
Male	67.8	23.4	57.4	24.7	47.6	26.4	64.5	9.5	94.9	27.7	522.4	26.4
Female	84.0	16.7	65.8	24.9	69.4	25.1	66.2	9.9	95.6	28.0	528.9	25.9
Speech												
Male	66.3	22.3	68.7	34.0	50.9	30.1	62.9	10.8	91.7	26.4	533.8	23.9
Female	83.3	16.6	68.3	22.8	75.1	19.0	64.8	11.6	93.5	35.8	528.4	65.9
Speech Path.												
Female	86.9	11.5	85.7	9.8	74.5	21.6	67.1	8.3	89.5	24.5	543.5	29.9

Table 3.24

Selected Percentile Points from the Cumulative Percentage Distributions of High School Rank (HSR) for Male and Female Students in Eight Secondary Education Curriculums

Major	Percentile						
	5	25	40	50	60	75	95
English							
Male	45.93	64,25	74.77	81.00	86.90	90.75	100.03
Female	72.67	84.00	90.25	92.83	94.83	97.12	100.03
For. Lang.							
Male	21.35	50.63	65.30	74.00	81.57	88.25	99.58
Female	63.77	82.50	89.70	93.17	94.90	97.70	99.90
Math							
Male	43.80	73.00	84.63	88.36	91.82	94.75	99.59
Female	87.98	91.88	95.30	96.88	97.85	99.15	100.26
Nat. Sci.							
Male	31.25	56.38	67.50	75.25	81.50	88.13	99.71
Female	77.95	87.13	90.10	93.00	94.70	97.75	100.21
Phy. Sci.							
Male	44.30	68.50	82.90	85.50	91.10	96.50	100.05
Soc. St.							
Male	22.80	54.00	67.38	72.50	79.10	85.75	97.73
Female	49.15	75.25	85.90	89.33	92.30	95.75	99.98
Speech							
Male	27.45	46.25	64.80	70.00	75.90	85.25	97.55
Female	44.35	76.63	84.40	86.25	89.60	95.65	99.79
Speech Path.							
Female	67.55	80.81	85.78	90.00	92.30	96.69	99.89

Table 3.25

Selected Percentile Points from the Cumulative Percentage Distributions of Minnesota Scholastic Aptitude Test (MSAT) for Male and Female Students in Eight Secondary Education Curriculums

Major	Percentile 5	25	40	50	60	75	95
English							
Male	50.85	66.25	75.30	79.00	80.70	90.75	97.15
Female	68.80	85.00	91.63	92.50	95.30	97.25	98.85
For. Lang.							
Male	40.80	43.00	84.90	85.50	92.10	93.00	94.20
Female	22.35	73.75	85.10	88.00	89.10	93.25	97.65
Math							
Male	48.10	69.00	82.30	85.50	87.70	89.50	96.90
Female	58.00	92.00	94.50	95.00	95.50	96.25	99.00
Nat. Sci.							
Male	50.75	71.75	72.50	79.00	79.50	89.25	98.25
Female	65.55	65.75	65.90	66.00	66.10	66.25	66.45
Phy. Sci.							
Male	57.60	58.00	58.30	58.50	93.70	94.00	94.40
Soc. St.							
Male	14.50	39.50	50.50	56.17	66.50	74.50	93.00
Female	21.00	48.00	58.50	60.50	74.50	87.00	96.00
Speech							
Male	29.65	30.25	81.70	82.00	82.30	93.75	94.35
Female	30.15	47.75	65.70	72.00	76.30	91.88	94.85
Speech Path.							
Female	64.30	81.50	85.90	87.50	88.80	91.50	98.70

Table 3.26

Selected Percentile Points from the Cumulative Percentage Distributions of Co-op English Test (Eng) for Male and Female Students in Eight Secondary Education Curriculums

Major	Percentile						
	5	25	40	50	60	75	95
English							
Male	24.45	63.08	72.10	76.75	82.63	86.12	94.53
Female	51.30	80.17	83.67	85.17	88.16	91.61	98.20
For. Lang.							
Male	5.55	32.75	40.20	49.00	60.30	82.08	90.48
Female	23.90	69.10	82.23	84.00	87.46	91.25	97.45
Math							
Male	10.60	43.50	64.90	69.30	75.78	82.75	92.30
Female	44.55	78.75	84.63	86.67	89.62	91.69	98.09
Nat. Sci.							
Male	3.45	22.88	47.30	54.75	68.30	78.63	90.55
Female	40.10	67.83	73.40	76.50	81.70	84.25	91.90
Phy. Sci.							
Male	15.30	51.50	63.30	73.00	81.10	84.00	91.10
Soc. St.							
Male	6.44	24.85	37.50	46.60	57.67	71.96	86.63
Female	12.40	55.00	74.70	79.50	82.95	87.38	95.60
Speech							
Male	5.65	23.25	42.10	48.75	55.30	79.75	97.35
Female	29.65	67.94	77.57	82.20	84.77	88.63	93.46
Speech Path.							
Female	19.80	65.00	78.97	82.75	83.65	89.25	95.85

Table 3.27

Selected Percentile Points from the Cumulative Percentage Distributions of Miller Analogies Test (MAT) for Male and Female Students in Eight Secondary Education Curriculums

Major	Percentile 5	25	40	50	60	75	95
English							
Male	52.30	64.17	68.97	71.33	74.37	79.17	86.10
Female	54.85	63.84	68.12	70.63	73.25	76.97	83.66
For. Lang.							
Male	44.00	58.25	63.10	64.50	66.00	72.75	81.00
Female	49.53	59.04	65.27	68.13	70.83	74.09	82.45
Math							
Male	52.55	63.52	66.41	69.58	72.22	76.47	84.15
Female	54.95	65.25	68.20	69.75	71.05	75.31	85.15
Nat. Sci.							
Male	53.25	62.44	67.10	69.14	71.50	74.56	84.58
Female	52.25	64.08	68.83	70.00	72.00	74.13	81.75
Phy. Sci.							
Male	53.53	64.58	72.90	75.67	77.03	79.75	85.24
Soc. St.							
Male	48.10	58.70	61.88	64.43	66.65	70.88	81.54
Female	48.30	60.83	64.35	67.67	69.42	73.50	79.23
Speech							
Male	40.85	56.88	60.90	63.88	66.05	69.75	82.15
Female	44.30	57.50	64.10	66.33	68.70	73.00	82.35
Speech Path.							
Female	52.28	61.79	64.85	66.67	69.65	73.05	79.73

Table 3.28

Selected Percentile Points from the Cumulative Percentage Distributions of Co-op Reading Test (Rdng) for Male and Female Students in Eight Secondary Education Curriculums

Major	Percentile						
	5	25	40	50	60	75	95
English							
Male	64.30	94.50	102.26	106.10	111.80	124.50	168.90
Female	66.90	95.38	104.80	110.00	115.43	127.83	163.57
For. Lang.							
Male	5.55	32.75	40.20	49.00	60.30	82.08	90.48
Female	23.90	69.10	82.23	84.00	87.46	91.25	97.45
Math							
Male	40.55	66.67	79.26	88.25	94.10	104.94	129.98
Female	49.20	82.00	91.03	94.17	100.70	112.75	134.15
Nat. Sci.							
Male	36.33	69.00	83.30	90.25	95.17	111.00	161.00
Female	40.00	78.00	87.83	100.00	110.50	114.63	151.00
Phy. Sci.							
Male	46.60	74.75	84.90	97.50	106.10	115.25	148.40
Soc. St.							
Male	52.30	75.00	88.33	94.25	100.65	109.90	144.70
Female	50.10	60.50	86.10	94.50	103.10	115.50	142.90
Speech							
Male	45.20	72.00	88.10	95.50	100.63	105.75	139.80
Female	37.70	63.83	82.90	92.50	103.30	116.50	155.30
Speech Path.							
Female	48.05	70.00	80.90	90.00	97.10	106.00	135.40

Table 3.29

Selected Percentile Points from the Cumulative Percentage Distributions of Minnesota Teacher Attitude Test (MTAT) for Male and Female Students in Eight Secondary Education Curriculums

Major	Percentile						
	5	25	40	50	60	75	95
English							
Male	484.10	512.00	526.63	529.83	535.10	547.50	566.90
Female	487.37	513.75	527.46	534.50	540.67	550.36	577.85
For. Lang.							
Male	469.40	496.75	510.23	518.83	523.30	537.25	557.05
Female	480.55	507.58	518.70	525.00	532.90	542.25	581.13
Math							
Male	467.18	492.67	507.76	514.63	519.70	527.38	558.40
Female	487.85	508.00	518.37	529.50	535.97	545.75	565.80
Nat. Sci.							
Male	473.25	499.25	513.50	520.17	527.17	541.58	568.67
Female	462.00	491.25	512.50	529.50	534.50	545.00	565.00
Phy. Sci.							
Male	464.50	500.50	509.17	516.50	521.50	530.50	561.50
Soc. St.							
Male	473.60	505.44	518.94	523.90	531.40	540.25	564.73
Female	495.25	510.00	517.83	522.36	533.00	548.67	579.00
Speech							
Male	492.85	514.38	527.30	537.50	542.63	549.75	565.80
Female	479.70	513.50	525.62	537.50	545.60	557.30	585.30
Speech Path.							
Female	493.60	526.88	537.30	545.00	553.10	565.63	585.40

Table 3.30

Means and Standard Deviations of Four Academic Variables for Male and Female Students in Eight Curriculums in Secondary Education

Major	Transfer GPA		Overall GPA		Jr. Sequence GPA		St. Teach. GPA	
	$\bar{x}$	sd	$\bar{x}$	sd	$\bar{x}$	sd	$\bar{x}$	sd
English								
Male	2.71	.46	2.78	.43	2.64	.73	3.30	.61
Female	2.97	.47	2.92	.48	2.75	.81	3.40	.58
For. Lang.								
Male	2.67	.44	2.74	.59	2.33	.77	3.28	.66
Female	2,90	.46	2.94	.53	2.55	.77	3.39	.57
Math								
Male	2.73	.44	2.70	.54	2.65	.77	3.21	.66
Female	2.94	.48	2.82	.53	2.83	.73	3.36	.44
Nat. Sci.								
Male	2.49	.41	2.69	.48	2.45	.71	3.30	.53
Female	2.88	.47	2.84	.45	2.73	.67	2.99	.56
Phy. Sci.								
Male	2.64	.35	2.76	.48	2.84	.72	3.22	.46
Soc. St.								
Male	2.62	.39	2.74	.42	2.64	.73	2.92	.61
Female	2.81	.43	2.75	.55	2.61	.82	3.18	.68
Speech								
Male	2.38	.40	2.39	.52	2.22	.65	3.41	.52
Female	2.63	.50	2.58	.53	2.31	.88	3.24	.70
Speech Path.								
Female	2.66	.47	2.78	.51	2.69	.82	3.47	.45

Table 3.31

Selected Percentile Points from the Cumulative Percentage Distributions of Transfer Grade Point Average for Male and Female Students in Eight Secondary Education Curriculums

Major	Percentile 5	25	40	50	60	75	95
English							
Male	1.96	2.32	2.55	2.68	2.81	3.05	3.46
Female	2.27	2.62	2.76	2.94	3.09	3.31	3.80
For. Lang.							
Male	1.98	2.34	2.58	2.64	2.74	2.96	3.38
Female	2.17	2.55	2.69	2.88	3.05	3.23	3.65
Math							
Male	2.17	2.35	2.51	2.82	2.81	2.97	3.61
Female	2.07	2.64	2.82	2.94	3.01	3.23	3.75
Nat. Sci.							
Male	1.94	2.19	2.31	2.41	2.53	2.74	3.33
Female	2.16	2.58	2.73	2.85	2.99	3.14	3.82
Phy. Sci.							
Male	2.15	2.38	2.48	2.58	2.67	2.88	3.24
Soc. St.							
Male	2.06	2.34	2.49	2.57	2.67	2.86	3.32
Female	2.12	2.48	2.60	2.77	2.87	3.15	3.57
Speech							
Male	1.94	2.14	2.24	2.34	2.39	2.55	3.23
Female	1.91	2.23	2.44	2.57	2.73	2.97	3.69
Speech Path.							
Female	2.10	2.26	2.44	2.59	2.74	3.00	3.51

Table 3.32

Selected Percentile Points from the Cumulative Percentage Distributions of Junior Sequence Grade Point Average for Male and Female Students in Eight Secondary Education Curriculums

Major	Percentile						
	5	25	40	50	60	75	95
English							
Male	1.52	1.99	2.49	2.52	2.97	3.00	3.98
Female	1.50	1.99	2.50	2.52	2.99	3.50	3.99
For. Lang.							
Male	1.49	1.52	1.99	2.00	2.51	2.98	3.97
Female	1.49	1.98	2.25	2.51	2.97	3.00	3.98
Math							
Male	1.50	1.99	2.49	2.51	2.97	3.01	3.98
Female	1.97	2.00	2.51	2.97	2.99	3.50	3.99
Nat. Sci.							
Male	.98	1.98	2.00	2.49	2.51	2.98	3.74
Female	1.97	2.00	2.50	2.52	2.78	3.00	3.98
Phy. Sci.							
Male	1.97	2.26	2.74	2.97	2.99	3.00	3.99
Soc. St.							
Male	1.49	1.99	2.47	2.51	2.97	3.01	3.97
Female	1.45	1.99	2.49	2.51	2.79	3.45	3.96
Speech							
Male	.99	1.97	1.99	2.00	2.45	2.97	3.00
Female	.68	1.97	1.99	2.00	2.46	2.99	3.94
Speech Path.							
Female	1.45	2.00	2.46	2.47	2.97	3.46	3.95

Table 3.33

Selected Percentile Points from the Cumulative Percentage Distributions of Overall Grade Point Average for Male and Female Students in Eight Secondary Education Curriculums

Major	Percentile						
	5	25	40	50	60	75	95
English							
Male	2.00	2.43	2.65	2.79	2.86	3.02	3.61
Female	2.00	2.53	2.77	2.93	3.07	3.27	3.67
For. Lang.							
Male	1.87	2.47	2.56	2.73	2.85	3.07	3.63
Female	2.09	2.62	2.84	2.99	3.11	3.32	3.63
Math							
Male	1.83	2.38	2.58	2.68	2.77	3.07	3.61
Female	1.90	2.40	2.74	2.84	3.02	3.13	3.59
Nat. Sci.							
Male	1.83	2.40	2.53	2.64	2.74	3.06	3.50
Female	2.15	2.55	2.65	2.69	2.86	3.16	3.69
Phy. Sci.							
Male	2.05	2.45	2.62	2.82	2.96	3.08	3.50
Soc. St.							
Male	2.14	2.44	2.63	2.74	2.83	3.00	3.43
Female	1.72	2.42	2.64	2.84	2.98	3.14	3.51
Speech							
Male	1.65	2.12	2.36	2.40	2.51	2.71	3.15
Female	1.75	2.16	2.41	2.55	2.69	2.98	3.40
Speech Path.							
Female	1.99	2.40	2.64	2.75	2.92	3.18	3.66

2

Table 3.34

Selected Percentile Points from the Cumulative Percentage Distributions of Student Teaching Grade Point Average for Male and Female Students in Eight Secondary Education Curriculums

Major	Percentile						
	5	25	40	50	60	75	95
English							
Male	2.27	2.98	3.00	3.30	3.32	3.97	4.00
Female	2.25	2.98	3.29	3.65	3.67	3.98	4.00
For. Lang.							
Male	1.99	2.97	2.99	3.00	3.67	3.97	4.00
Female	2.32	2.98	3.00	3.31	3.67	3.98	4.00
Math							
Male	2.00	2.97	2.99	3.00	3.31	3.67	4.00
Female	2.97	2.98	2.99	3.00	3.65	3.68	4.00
Nat. Sci.							
Male	2.33	2.98	3.00	3.29	3.34	3.97	4.00
Female	1.99	2.67	2.97	2.98	2.99	3.31	3.98
Phy. Sci.							
Male	2.31	2.98	2.99	3.00	3.30	3.53	3.99
Soc. St.							
Male	1.98	2.64	2.97	2.98	2.99	3.30	3.98
Female	2.30	2.68	2.98	2.99	3.00	3.65	4.00
Speech							
Male	2.61	2.99	3.29	3.32	3.64	3.94	3.96
Female	1.48	2.97	3.00	3.30	3.61	3.93	3.96
Speech Path.							
Female	2.61	3.30	3.61	3.62	3.63	3.64	3.96

Table 3.35 - School of Prior Registration for Male and Female Students in Five Special Fields Curriculums

Major	High School		Off Campus		On Campus						Total	
					CLA		GC		Other			
	f	%	f	%	f	%	f	%	f	%	f	%
Art												
Male	7	12.5	6	10.7	28	50.0	14	25.0	1	1.8	56	100.0
Female	27	18.9	33	22.5	74	51.4	5	3.6	5	3.6	144	100.0
Business												
Male	1	1.5	19	27.5	19	27.5	5	7.3	25	36.2	69	100.0
Female	7	13.7	27	52.9	13	25.5	0	0.0	4	7.9	51	100.0
Industrial												
Male	38	21.6	38	21.6	38	21.6	37	21.0	25	14.2	176	100.0
Music												
Male	21	32.8	12	18.8	24	37.5	2	3.1	5	7.8	65	100.0
Female	17	20.7	33	40.3	29	35.4	2	2.4	1	1.2	82	100.0
PEM	56	30.6	23	21.6	33	18.0	50	27.3	21	11.5	183	100.0
PEW	58	46.4	34	27.2	27	21.6	0	0.0	6	4.8	125	100.0

The level at which students in Special Fields entered is shown in Table 3.36. The table illustrates the diversity of their level at the point of entry. Of the Art Education majors, only one-fourth of the men and just over a third of the women enter prior to the junior year. Though over half the women in Business Education enter before the junior year, only one in five of the men do so, and more than half of the men enter with enough transfer credits to be classified as a senior. Just over half the Industrial Education men transfer prior to the junior year, and more than half of those in Music Education enter before the junior year. Two-thirds of the men in Physical Education and four-fifths of the women in Physical Education enter before the junior year.

Tables 3.37 and 3.38 presents high school and community data. Art Education majors, more than those from other Special Fields, came from large high schools and from urban communities. Less than one in five came from public schools of less than 1000, while other Special Fields had twice that proportion from schools of that size. In general, about a third of the students in Special Fields went to high school in urban areas and an equal number attended in communities of less than 10,000 population.

The differences in the ages of the Special Fields majors at the time they entered the junior year is shown in Table 3.39. The striking differences are shown in comparisons of men's and women's ages. Over half to two-thirds of the women in the several fields were less than 21 years of age when they were juniors while only one-sixth to three-tenths of the men were in that age range. Over half of the men in Art, Business, and Industrial Education were twenty-four or older. Men in Physical Education, though older than the women, were younger than the men in other Special Fields.

Psychometric Data

Tables 3.40 through 3.46 presents the summary statistics and the cumulative percentage distributions for the six psychometric variables. The general tendency for women to score higher and be less variable than men is expected. These differences are greater in the results of data from high shool than from the test battery administered before admission to Education.

Academic Data

The grade point data presented in Tables 3.47 through 3.51 show one noticeable difference when compared with other groups of students considered in previous sections of this chapter. With the exception of Business Education students, those in Special Fields clearly do less well in the professional sequence of courses given in the junior year. From 50% to 60% of the Special Fields students, except those in Business, made less than a C average (2.0) in the Junior Sequence while only 5% to 25% of the Secondary Academic majors made grades of C or less.

Table 3.36 - Level of Prior Preparation for Male and Female Students in Five Special Fields Curriculums

Major	High School		Freshman		Sophomore		Advanced Standing				Total	
							Junior		Senior			
	f	%	f	%	f	%	f	%	f	%	f	%
Art												
Male	9	15.9	0	0.0	5	8.7	30	52.6	13	22.8	57	100.0
Female	25	17.2	7	4.8	20	13.8	70	48.3	23	15.9	145	100.0
Business												
Male	1	1.4	2	2.8	11	15.5	19	26.8	38	53.5	71	100.0
Female	7	31.5	4	7.7	14	26.9	23	44.2	4	7.7	52	100.0
Industrial												
Male	37	21.0	16	9.1	45	25.6	65	36.9	13	7.4	176	100.0
Music												
Male	22	34.4	8	12.5	10	15.6	14	21.9	10	15.6	64	100.0
Female	17	20.7	5	6.1	23	28.1	31	37.8	6	7.3	82	100.0
PEM												
Male	59	32.1	12	6.5	52	28.3	49	26.6	12	6.5	184	100.0
PEW												
Female	59	47.2	10	8.0	29	23.2	23	18.4	4	3.2	125	100.0

Table 3.37 - Size and Type of High School from Which Male and Female Students in Five Special Fields Curriculums Graduated

Major	Public											
	<1000		1000-2000		>2000		Private		Other		Total	
	f	%	f	%	f	%	f	%	f	%	f	%
Art												
Male	11	19.3	4	7.0	38	66.7	2	3.5	2	3.5	57	100.0
Female	21	.5	19	13.1	84	57.9	9	6.2	12	8.3	145	100.0
Business												
Male	25	35.2	8	11.3	26	36.6	3	4.2	9	12.7	71	100.0
Female	20	38.5	5	9.6	15	28.9	2	3.8	10	19.2	52	100.0
Industrial												
Male	51	29.0	26	41.8	78	44.3	4	2.3	17	9.6	176	100.0
Music												
Male	19	29.7	7	10.9	24	37.5	5	7.8	9	14.1	64	100.0
Female	24	29.3	12	14.6	22	26.8	4	4.9	20	24.4	82	100.0
PEM												
Male	44	23.9	24	31.0	85	46.2	4	2.2	27	14.7	184	100.0
PEW												
Female	32	25.6	17	13.6	62	49.6	7	5.6	7	5.6	125	100.0

Table 3.38 - Size of Community in Which the High School Was Located for Male and Female Students in Five Special Fields Curriculums

Major	Urban		Suburban		<10,000		10-20,000		>20,000		Out of State		Total	
	f	%	f	%	f	%	f	%	f	%	f	%	f	%
Art														
Male	31	54.4	7	12.3	14	24.6	2	3.5	1	1.7	2	3.5	57	100.0
Female	77	53.1	18	12.4	28	19.3	5	3.5	5	3.4	12	8.3	145	100.0
Business														
Male	26	36.6	0	0.0	26	36.6	9	12.7	1	1.4	9	12.7	71	100.0
Female	9	17.3	5	9.6	22	42.3	2	3.9	4	7.7	10	19.2	52	100.0
Industrial														
Male	75	42.6	6	3.4	68	38.6	8	4.6	2	1.1	17	9.7	176	100.0
Music														
Male	23	35.9	3	4.7	25	39.1	2	3.1	2	3.1	9	14.1	64	100.0
Female	22	26.8	3	3.7	29	35.4	3	3.6	5	6.1	20	24.4	82	100.0
PEM														
Male	77	41.9	10	5.4	58	31.5	8	4.4	4	2.2	27	14.7	184	100.0
PEW														
Female	57	45.6	10	8.0	41	32.8	9	7.2	1	.8	7	5.6	125	100.0

Table 3.39 - Age at Entrance to the Junior Sequence for Male and Female Students in Five Special Fields Curriculums

Major	< 20		20		21		22		23		24		> 24		Total	
	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%
Art																
Male	1	1.8	9	15.8	7	12.3	5	8.7	6	10.5	7	12.3	22	38.6	57	100.0
Female	12	8.3	74	51.0	28	19.3	12	8.3	6	4.1	0	0.0	13	9.0	145	100.0
Business																
Male	0	0.0	6	8.4	8	11.3	8	11.3	6	8.4	8	11.3	35	49.3	71	100.0
Female	1	1.9	28	53.9	9	17.3	3	5.8	0	0.0	0	0.0	11	21.1	52	100.0
Industrial																
Male	0	0.0	23	13.1	22	12.5	8	4.6	19	10.8	27	15.3	77	43.7	176	100.0
Music																
Male	2	3.1	20	31.2	7	10.9	9	14.1	5	7.8	9	14.1	12	18.8	64	100.0
Female	3	3.7	54	65.9	12	14.6	6	7.3	1	1.2	0	0.0	6	7.3	82	100.0
PEM																
Male	4	2.2	52	28.3	42	22.8	22	11.9	18	9.8	15	8.1	31	16.9	184	100.0
PEW																
Female	7	5.6	79	63.2	18	14.4	4	3.2	5	4.0	5	4.0	7	5.6	125	100.0

Table 3.40 - Means and Standard Deviations of Six Psychometric Variables for Male and Female Students in Five Curriculums in Special Fields

Major	HRS		MSAT		Eng		MAT		Rdng		MTAT	
	$\bar{x}$	sd	$\bar{x}$	sd	$\bar{x}$	sd	$\bar{x}$	sd	$\bar{x}$	sd	$\bar{x}$	sd
Art												
Male	56.2	25.1	47.0	29.8	34.1	30.1	58.0	11.8	74.8	34.8	528.8	55.4
Female	76.2	19.1	66.1	24.3	65.3	23.3	61.0	9.8	79.9	26.8	527.0	50.1
Business												
Male	67.8	22.3	14.0	0.0	40.9	26.4	60.9	9.1	86.2	27.6	524.2	31.9
Female	87.3	14.5	71.1	20.5	76.5	18.0	61.3	8.9	87.4	22.6	530.9	30.9
Industrial												
Male	53.0	22.8	48.3	26.7	31.9	29.0	56.8	10.5	67.8	29.5	512.8	44.1
Music												
Male	70.6	22.2	90.0	4.2	58.8	28.1	62.0	9.7	83.4	35.5	513.9	31.7
Female	81.5	18.9	92.5	5.9	71.1	22.0	62.0	10.6	80.8	31.5	524.1	29.8
Phy. Ed.												
Male	54.9	22.9	36.9	18.5	28.3	26.3	53.3	10.5	55.3	29.4	515.0	37.1
Female	78.7	16.6	57.1	21.8	61.6	22.2	58.7	9.7	67.1	27.6	522.0	43.1

Table 3.41

Selected Percentile Points from the Cumulative Percentage Distributions of High School Rank (HSR) for Male and Female Students in Five Special Fields Curriculums

Major	Percentile 5	25	40	50	60	75	95
Art							
Male	14.15	39.63	55.70	61.00	65.43	77.25	90.85
Female	39.25	55.25	76.50	82.50	86.17	91.58	98.08
Business							
Male	29.45	50.80	64.10	70.75	80.20	94.06	99.76
Female	65.00	83.67	89.30	92.50	95.57	97.20	99.98
Industrial							
Male	12.68	40.05	48.20	53.25	59.23	70.63	88.15
Music							
Male	29.25	57.25	69.00	76.00	81.17	89.06	98.75
Female	43.50	68.50	82.50	87.50	92.75	96.75	100.13
Phy. Ed.							
Male	11.05	42.24	48.23	53.25	64.80	72.58	87.95
Female	43.95	68.00	76.10	83.00	86.77	92.60	98.23

Table 3.42

Selected Percentile Points from the Cumulative Percentage Distributions of Minnesota Scholastic Aptitude Test (MSAT) for Male and Female Students in Five Special Fields Curriculums

Major	Percentile 5	25	40	50	60	75	95
Art							
Male	16.75	24.75	25.50	36.00	36.50	73.25	84.25
Female	19.35	50.75	65.77	66.33	79.10	82.25	95.65
Business							
Male	13.55	13.75	13.90	14.00	14.10	14.25	14.45
Female	35.90	46.50	73.70	74.50	81.30	84.50	92.10
Industrial							
Male	10.95	35.75	42.10	44.00	55.90	62.25	98.05
Music							
Male	86.60	87.00	87.30	87.50	92.70	93.00	93.40
Female	83.80	88.00	90.90	91.50	95.10	98.00	99.20
Phy. Ed.							
Male	10.70	21.50	27.10	39.00	41.20	48.00	60.40
Female	24.50	37.50	42.50	56.50	64.50	69.50	87.50

Table 3.43

Selected Percentile Points from the Cumulative Percentage Distributions of Co-op English Test (Eng) for Male and Female Students in Five Special Fields Curriculums

Major	Percentile 5	25	40	50	60	75	95
Art							
Male	.90	14.75	19.20	22.50	31.30	58.50	84.70
Female	19.60	53.25	65.30	72.00	76.50	83.15	91.67
Business							
Male	1.28	21.00	30.40	37.50	52.80	62.00	82.45
Female	24.50	72.50	81.50	82.50	84.00	88.50	93.50
Industrial							
Male	.95	4.63	12.94	22.25	34.40	53.44	82.95
Music							
Male	9.98	30.38	55.10	67.75	75.20	82.92	93.55
Female	27.75	59.58	68.50	78.75	83.33	87.67	97.08
Phy. Ed.							
Male	.93	5.98	12.57	20.13	25.90	48.75	78.35
Female	18.50	43.00	58.50	68.00	72.50	81.50	90.50

Table 3.44

Selected Percentile Points from the Cumulative Percentage Distributions of Miller Analogies Test (MAT) for Male and Female Students in Five Special Fields Curriculums

Major	Percentile 5	25	40	50	60	75	95
Art							
Male	38.40	51.67	54.94	56.50	60.30	66.33	76.60
Female	44.58	55.11	58.50	61.05	63.00	68.63	76.08
Business							
Male	43.28	55.44	58.70	61.63	63.40	66.95	76.73
Female	48.30	54.50	58.90	60.75	63.60	67.00	77.90
Industrial							
Male	40.88	48.45	53.75	56.81	59.50	64.75	73.63
Music							
Male	45.70	54.50	59.70	61.30	65.60	69.75	76.40
Female	44.50	54.83	60.17	62.50	64.50	69.50	80.50
Phy. Ed.							
Male	39.51	46.69	49.98	52.19	54.77	59.45	69.48
Female	45.10	51.50	55.45	57.83	60.60	65.10	76.77

Table 3.45

Selected Percentile Points from the Cumulative Percentage Distributions of Co-op Reading Test (Rdng) for Male and Female Students in Five Special Fields Curriculums

Major	Percentile 5	25	40	50	60	75	95
Art							
Male	26.40	42.00	64.63	73.50	84.10	97.00	140.70
Female	36.15	61.33	73.30	80.06	83.70	96.83	123.90
Business							
Male	32.05	70.38	79.90	89.00	96.10	104.67	132.95
Female	49.90	72.83	82.10	86.50	94.10	105.10	119.10
Industrial							
Male	20.30	45.50	60.26	65.17	75.24	88.00	116.70
Music							
Male	31.97	56.50	73.57	81.83	87.30	102.00	152.10
Female	35.60	55.50	67.30	79.70	89.30	102.83	140.30
Phy. Ed.							
Male	12.50	34.33	42.82	51.83	57.78	71.25	115.40
Female	23.10	51.25	59.86	64.00	72.10	81.50	116.20

Table 3.46

Selected Percentile Points from the Cumulative Percentage Distributions of Minnesota Teacher Attitude Test (MTAT) for Male and Female Students in Five Special Fields Curriculums

Major	Percentile 5	25	40	50	60	75	95
Art							
Male	484.30	509.00	522.90	531.17	534.40	551.50	576.70
Female	489.80	515.00	525.70	530.28	536.74	548.17	575.20
Business							
Male	473.28	502.25	514.20	522.83	529.57	549.75	579.40
Female	477.90	514.83	524.10	530.50	538.77	547.00	584.80
Industrial							
Male	458.10	493.50	506.61	514.00	520.50	536.50	570.70
Music							
Male	452.80	493.50	514.60	518.17	523.30	538.75	564.20
Female	468.60	500.13	523.30	528.75	532.80	541.38	570.40
Phy. Ed.							
Male	469.10	494.79	507.10	515.50	524.70	538.50	567.30
Female	476.90	503.70	518.30	526.50	532.66	543.83	576.10

Table 3.47

Means and Standard Deviations of Four Academic Variables for Male and Female Students in Five Curriculums in Special Fields

Major	Transfer GPA		Overall GPA		Jr. Sequence GPA		St. Teach. GPA	
	$\bar{x}$	sd	$\bar{x}$	sd	$\bar{x}$	sd	$\bar{x}$	sd
Art								
Male	2.36	.37	2.62	.36	1.85	.73	3.32	.59
Female	2.49	.41	2.68	.46	1.93	.70	3.33	.51
Business								
Male	2.43	.42	2.71	.62	2.54	.71	3.35	.56
Female	2.69	.44	2.74	.45	2.64	.73	3.49	.51
Industrial								
Male	2.25	.51	2.73	.37	2.07	.64	3.64	.40
Music								
Male	2.51	.51	2.68	.39	1.89	.72	3.48	.50
Female	2.91	.48	2.75	.41	2.22	.85	3.37	.46
Phy. Ed.								
Male	2.19	.44	2.45	.39	1.96	.70	3.50	.47
Female	2.34	.40	2.56	.42	2.09	.73	3.47	.52

Table 3.48

Selected Percentile Points from the Cumulative Percentage Distributions of Transfer Grade Point Average for Male and Female Students in Five Special Fields Curriculums

Major	Percentile						
	5	25	40	50	60	75	95
Art							
Male	1.97	2.10	2.18	2.25	2.31	2.58	3.00
Female	1.96	2.17	2.30	2.43	2.56	2.79	3.33
Business							
Male	1.97	2.13	2.22	2.33	2.46	2.65	3.28
Female	2.07	2.32	2.48	2.71	2.80	3.05	3.43
Industrial							
Male	1.50	1.96	2.06	2.18	2.27	2.53	3.15
Music							
Male	1.85	2.11	2.32	2.48	2.61	2.84	3.32
Female	2.07	2.51	2.73	2.92	3.00	3.23	3.71
Phy. Ed.							
Male	1.51	1.95	2.03	2.10	2.23	2.44	2.81
Female	1.85	2.07	2.18	2.23	2.33	2.55	3.00

Table 3.49

Selected Percentile Points from the Cumulative Percentage Distributions of Junior Sequence Grade Point Average for Male and Female Students in Five Special Fields Curriculums

Major	Percentile						
	5	25	40	50	60	75	95
Art							
Male	.97	1.00	1.97	1.98	1.99	2.00	3.46
Female	.98	1.46	1.48	1.98	1.99	2.45	3.45
Business							
Male	1.00	1.99	2.45	2.47	2.48	2.99	3.93
Female	1.47	1.99	2.46	2.48	2.97	3.00	3.94
Industrial							
Male	.99	1.48	1.98	1.99	2.00	2.46	3.45
Music							
Male	.97	1.46	1.65	1.98	1.99	2.45	3.46
Female	.97	1.48	1.98	2.00	2.45	2.97	3.94
Phy. Ed.							
Male	.97	1.50	1.97	1.98	1.99	2.49	3.49
Female	.98	1.52	1.98	1.99	2.00	2.50	3.51

Table 3.50

Selected Percentile Points from the Cumulative Percentage Distributions of Overall Grade Point Average for Male and Female Students in Five Special Fields Curriculums

Major	Percentile						
	5	25	40	50	60	75	95
Art							
Male	2.00	2.41	2.58	2.64	2.71	2.83	3.17
Female	1.98	2.09	2.58	2.65	2.76	2.94	3.40
Business							
Male	1.59	2.36	2.68	2.82	2.91	3.09	3.58
Female	1.83	2.48	2.66	2.75	2.86	3.04	3.27
Industrial							
Male	2.04	2.46	2.67	2.76	2.85	2.98	3.27
Music							
Male	2.03	2.42	2.58	2.69	2.78	2.93	3.32
Female	2.09	2.45	2.59	2.73	2.86	3.08	3.40
Phy. Ed.							
Male	1.91	2.20	2.32	2.41	2.50	2.63	3.28
Female	1.93	2.32	2.44	2.51	2.61	2.79	3.23

Table 3.51

Selected Percentile Points from the Cumulative Percentage Distributions of Student Teaching Grade Point Average for Male and Female Students in Five Special Fields Curriculums

Major	Percentile						
	5	25	40	50	60	75	95
Art							
Male	2.29	2.99	3.31	3.48	3.62	3.64	3.96
Female	2.32	2.98	3.29	3.45	3.61	3.64	3.96
Business							
Male	2.31	2.98	3.30	3.61	3.63	3.93	3.96
Female	2.62	3.00	3.12	3.63	3.93	3.94	3.96
Industrial							
Male	2.97	3.45	3.63	3.93	3.93	3.95	3.96
Music							
Male	2.61	3.00	3.61	3.62	3.64	3.93	3.96
Female	2.61	3.29	3.31	3.32	3.61	3.64	3.95
Phy. Ed.							
Male	2.97	3.00	3.32	3.65	3.67	3.97	4.00
Female	2.97	2.99	3.00	3.29	3.97	3.98	4.00

Chapter IV

Comparisons of Students in the Same Major Field Who Were Persists and Nonpersists

From the inception of the study, persistence was adopted as a criterion. Part I of the study presented the rationale for the criterion selection, and Chapter I of this report summarizes that discussion. The criterion of persistence was seen as a reasonable first step in the research. The application of the criterion poses the following question as presented in Chapter II:

Are there differences between those who persist in a major field and those who do not?

In Part I of the study, the analyses showed that the variables were able to classify or discriminate criterion groups effectively in three separate classes of women in the Elementary IA curriculum. There was not, however, any consistent pattern of data which characterized the results of the three analyses. The other three groups studied, women in English-Language Arts, men in Mathematics and Science, and men in Social Studies showed no differences between criterion groups on the measures studied.

The Subjects

The purpose of this chapter is to report on further analyses of the question of persistence using a broader representation of teacher education major fields and larger numbers of students in each field. In these analyses, men and women subjects were studied separately.

Table 4.1 identifies the eight groups of students studied. For each group, the number and percent identified as persists and nonpersists are given as reported in Chapter II. These eight groups represent those major fields having criterion groups of sufficient size to yield reliable results. The variation among these groups in the percent classified as nonpersists is small. The table also indicates the size of the analysis group -- the number for whom there were complete data. A comparison of the population totals and the analysis group totals shows that the maximum shrinkage was less than 3% for the most discrepant; and, though not reported here, the shrinkage was not disproportional among the groups. At the beginning of the longitudinal study, a new record keeping system was designed to insure maximum completeness of data. The data in Table 4.1 are a reasonable basis for judging that the data gathering system worked satisfactorily. Parenthetically, just prior to the installation of a data gathering system which would meet rigorous research requirements, the number of cases lacking complete data for one study was approximately fifty percent.

The Variables and the Analysis

Variables selected for analyses were those that, according to the design of the study, should have been complete for both persists and nonpersists. The psychometric, biographical, and academic data required for admission and the over-all grade point average, the index of achievement for the time enrolled, were the variables and are listed in Table 4.2. These variables are described in detail in Chapter II.

Table 4.1

Eight Groups of Students in Teacher Education Classified by Persistence and the Number in Each Group Utilized in Prediction of Persistence Analysis

	Population					Analysis Group
	Persists		Non Persists		Total	
Groups	N	%	N	%	N	N
Elementary IA - Men	162	83	33	17	195	195
Elementary IA - Women	1209	85	208	15	1417	1411
English - Women	176	83	35	17	211	208
Mathematics - Men	133	82	29	18	162	161
Social Studies - Men	176	73	64	27	240	235
Art - Women	115	79	31	21	146	146
Physical Education-Men	148	80	37	20	185	185
Physcial Education - Women	105	81	74	19	129	126

Table 4.2

Product Moment(r), Partial(r*), and Multiple(R) Correlations between Nine Variables and Persistence in Teacher Education for Eight Groups of Students

Variables	Corr.	Elem.		Eng.	Math	Soc St	Art	PE	PE
		M	F	F	M	M	F	M	F
Entry Level	r	.03	.04	.00	.05	.00	.01	.13	.09
	r*	.01	.03	-.07	.09	-.03	-.02	.26	.08
	sig.							**	
High School	r	.06	.05	.12	-.06	-.02	.02	-.03	-.04
	r*	.10	.03	.11	-.14	-.05	-.01	-.04	-.04
	sig.								
Age	r	-.05	.01	-.04	-.02	.13	-.03	.00	.15
	r*	-.14	.04	.00	.05	.11	.00	.04	.31
	sig.								
HSR	r	-.12	-.11	-.31	-.07	-.04	-.08	-.09	-.08
	r*	-.02	-.04	-.24	.11	.01	.02	.10	.11
	sig.			**					
MSAT	r	.00	-.07	-.10	-.10	.02	.00	-.11	.00
	r*	-.01	-.01	-.07	.00	.02	.02	-.10	.12
	sig.								
MAT	r	-.04	-.11	-.13	-.09	.06	.00	-.08	-.05
	r*	.02	.01	-.04	-.04	.03	.04	.05	-.01
	sig.								
Rdng.	r	.03	-.06	.08	-.13	.10	.01	.00	-.02
	r*	.12	.06	.21	-.01	.06	.04	.15	.07
	sig.								
MTAI	r	.08	-.06	-.11	.01	.00	.07	-.10	.01
	r*	.17	-.03	-.11	.03	.01	.06	-.12	.07
	sig.								
OGPA	r	-.51	-.39	-.29	-.49	-.13	-.29	-.38	-.42
	r*	-.52	-.38	-.19	-.50	-.14	-.29	-.45	-.52
	sig.		**	**	**	**	**	**	**
Linear Combination	R	.56**	.41**	.44**	.52**	.22	.32	.49**	.55**
	R*	.31	.16	.19	.27	.05	.10	.24	.31

The analyses needed to provide an answer to this question: do the data on the nine independent variables effectively discriminate or permit a classification of subjects in the two criterion groups? Though the problem is essentially one of classification requiring discriminant analysis techniques, the multiple regression procedure is equivalent when the criterion is dichotomous, in this case, persists and nonpersists. Thus a standard computer program for multiple regression analysis was cused to find whether the nine independent variables could effectively predict persistence. A score of one was assigned for persists and two for nonpersists. The effectiveness of the linear combination of variables in predicting is indicated by the value of R, the multiple correlation coefficient and of R^2 the proportion of variance accounted for by the relationship. In addition, the analysis yielded the product-moment correlation, r, of each independent variable with the criterion; and the partial correlation, r*, the unique or particular relationship of each independent variable with the criterion separating out the effects of the other variables. Appropriate interpretation of the data depends on recognition of the inverse relationship of criterion and predictor scores. Negative correlations indicating high scores are related to persistence. One further aspect of the analysis is presented in Table 4.2 in addition to the four statistics, R, R^2 , r, and r*. The contribution of each independent variable to multiple correlation, regardless of the size of R, is indicated by the presence of asterisks (*) to indicate the 5% level of significance. This significance was determined by whether the weighting of the particular variable usually referred to as "b" or "beta", when divided by the appropriate standard deviation, yields a "t" statistic value larger than would be expected by chance. Table 4.2, then, presents five statisitics: 1) r; 2) r*; 3) R; 4) R^2 ; and 5) significance (*) of variables.

The Results

For six of the eight groups studied, the multiple correlation coefficient, R, was larger than could have been expected by chance at the 1% level of confidence. Only for men in Social Studies and women in Art was the data ineffective in distinguishing persists from nonpersists. Looking at the effectiveness of the variables, only the over-all grade point average made any general contribution to significant R's. In every group, high achievement in the College was related to persistence. In the case of Physical Education men, the Entry Level variable was significant; earlier entry related to persistence. For Physical Education women, the younger their age in the junior year, the more likely students were to persist. The higher their HSR, the more likely were English women to persist. Both women in English and Elementary had Rdng. scores which contributed significantly; higher scores tended to be related to nonpersistence. For men in Elementary Education, higher MTAI scores tended to predict nonpersistence.

Though the foregoing statements are appropriate in a technical sence, the data also requires a more practical interpretation. For only two groups, men in Elementary and women in Physical Education, were the values of R high enough that the relationship of the nine predictor variables to the criterion could account for 30% of the variability in criterion scores. For Elementary men, OGPA and MTAI were significant contributors to R; and for Physical Education women, OGPA and Age at the junior year, and in each case, OGPA showed the strongest relationship.

If performance in the College is the most powerful predictor of persistence, and if data on variables available at the time admission is considered, are not effective predictors; then persistence is more of a retention question than one of admissions. The relatively high percentage who persist makes it difficult to improve on persistence rates by changes of standards for admission to the junior year.

Next steps would move toward other criteria, preferably competence of performance, in studying questions of admission and retention.

Chapter V

Comparisons of Men and Women Persists in the Same Major Field

From the outset, this longitudinal research collected and analyzed data separately for men and women in the same curriculum. One objective for the study was to describe the differences between men and women in the same curriculum. Part I of the study did not have large enough numbers in any major field to permit such an analysis. The purpose of this chapter is to present the results of analysis of data for students in eight curriculums conducted to test whether the men and women who were classified as persists had different patterns of scores on the biographic, psychometric, and academic data.

The Subjects

Table 5.1 presents the numbers and percents of men and women in each field studied. These data are drawn from Chapter II. The proportion of men in the groups varies from about 10% in Elementary to about 70% in Social Studies. The fields of Business, Music, and Physical Education tend to be more evenly divided. The Business major, however, is more correctly titled Business and Distributive Education, and more women enter the Business option and more men elect the Distributive option. In Physical Education, comparisons may be misleading for the curriculums are separate as are departments and faculties who organize and teach the programs. The Physical Education comparisons are made on the assumption that the data may provide useful descriptive information about these fields for they have as much or more in common as teaching fields than they have differences.

The numbers in the analysis are also provided in Table 5.1. The shrinkage for lack of complete data was largest, over 5%, in Business and Music. In these two curriculums, larger percents have attended out-of-state high schools than other fields (see Chapter II) making it more likely that they did not complete the high school battery of tests included in the analysis.

The Variables and the Analysis

Those biographical, psychometric, and academic variables which were routinely collected upon admission to the junior year and those related to high school that were most likely to be available for all subjects, constituted the ten variables. Only those variables were omitted that would tend to reduce excessively the number of subjects having complete data without compensating sufficiently by giving added information. The ten variables are listed in Table 5.2 and completely described in Chapter II.

The problem of whether a given set of data can adequately describe or differentiate men and women in the same curriculum, is one of classification. Normally, the discriminant analysis, D^2, would be the appropriate procedure; but when the criterion group has only two categories, the multiple regression technique yields the same results. Thus in this problem as in the one presented in the previous chapter, a standard multiple regression computer program was used. The results of the analysis are presented in Table 5.2.

Table 5.1

Students who Persisted in Eight Teacher Education Curriculums Classified by Sex and the Number in Each Curriculum Utilized in Analysis of Sex Differences

Curriculum	Male N	Male %	Female N	Female %	Total N	Analysis Group N
Elementary	162	11	1209	89	1371	1360
English	66	37	176	63	242	237
Foreign Language	42	28	107	72	149	147
Social Studies	176	69	77	31	253	243
Art	50	29	115	71	162	162
Business	55	54	47	46	102	93
Music	54	44	69	56	123	114
Physical Education	148	58	105	42	253	247

Table 5.2

Product Moment (r), Partial (r*), and Multiple (R) Correlations between Nine Variables and the Sex of the Students who Persisted in Eight Teacher Education Curriculums

Variables	Corr	Elem	Eng	For. Lang	Soc. Stu	Art	Bus	Mus	P.E.
Entry Level	r	-.18	-.11	-.31	.02	-.09	-.46	.21	-.17
	r*	-.14	-.06	-.10	-.01	-.06	-.37	.29	-.04
	sig.	***					***	**	
High School	r	.04	-.03	-.17	.13	.07	.19	.31	-.07
	r*	.12	-.06	-.06	.12	.06	.27	.20	-.06
	sig.	***					*	*	
Age	r	-.23	-.03	-.17	-.03	-.24	-.37	-.38	-.24
	r*	-.15	-.01	.01	.04	-.10	-.28	-.35	-.10
	sig.	***					**	***	
HSR	r	.41	.48	.62	.38	.43	.48	.26	.53
	r*	.36	.43	.53	.32	.35	.35	.06	.40
	sig.	***	***	***	***	***	***		***
MSAT	r	.17	.17	.23	.24	.27	.36	.21	.28
	r*	.07	.10	.07	.04	.11	.09	.03	.05
	sig.	**							
MAT	r	.02	-.05	.11	.17	.15	.07	-.01	.24
	r*	-.09	-.18	-.07	.02	-.02	-.10	-.06	-.02
	sig.	***	**						
Rdng	r	-.01	.01	.11	.13	.06	.12	.03	.20
	r*	-.03	.00	.06	.06	-.08	.13	-.02	.06
	sig.								
MTAI	r	.03	.11	.17	.10	-.03	.18	.19	.07
	r*	.03	.12	.13	.09	-.01	.20	.17	.02
	sig.								
OGPA	r	.07	.17	.14	.14	.08	-.11	.05	.16
	r*	.02	.09	.04	.03	.07	.04	-.12	-.01
	sig.								
55-75 GPA	r	.01	.07	.13	.05	.03	-.01	.16	.06
	r*	-.06	-.06	-.10	-.06	-.07	-.11	.12	-.06
	sig.	*							
Linear Combination	R	.49**	.53**	.65**	.43**	.48**	.71**	.57**	.55**
	R^2	.24	.28	.42	.19	.23	.50	.32	.30

The multiple correlation, R, indicates the extent to which the ten predictor variables effectively predicted or classified students in a major field into male and female groups. The statistic, r, is an estimate of the product-moment correlation indicating the relationship between each predictor and the criterion. The partial correlation, r*, shows the relationship of the predictor to the criterion, holding constant the other variables. In addition to these correlations, Table 5.2 indicates by the use of asterisks (*), wheter a variable contributes to the multiple correlation beyond chance expectations; and R^2 indicates the proportion of the variability in the criterion which can be accounted for by the predictors. In interpreting the correlations, it is important to know that men were given a score of one and women a score of two. Positive correlations indicate that women tend to have higher scores.

The Results

The multiple correlations for all eight fields were significantly larger than chance at the 1% level of confidence. Men and women did have different patterns of scores. Noteworthy among these statistics was the relationship for Business majors. The R = .71 indicates that the predictors accounted for 50% of the variability in the criterion, an unusual degree of effectiveness. The most effective single variable in all major fields was HSR as indicated by the size of r* for each group. Only for Music majors did HSR fail to be a contributing variable. For four of the groups, HSR was the only significant variable contributing to the value of R.

In considering the practical interpretation of the data in Table 5.2 for only two major fields, do the data yield to meaningful interpretations. The pattern for Business majors suggests that men tend to enter the program with more previous college work, and they were older than the women. They were more likely to have attended smaller high schools, and performed less well as indicated by HSR. For the Music majors, the women tend to enter the program with more previous work; but the men, like those in Business, tend to come from smaller high schools and are older when they are juniors. Unlike any other group, HSR was not a variable which distinguished men and women in Music Education.

Though seven of the ten variables were effective predictors in the analysis of Elementary Education majors, these results must be largely discounted. The large sample size made it possible to detect small relationships reliably, but the size of the r*'s is, with the exception of HSR, too small to be of practical importance. In four groups, HSR was the only significant predictor, and in the case of Foreign Language majors, the r* was unusually large, r* = .53. The fact that women consistently out perform men in high school is well-known, and even an unusually large relationship is of little practical value for admission or retention purposes.

In general, then, men and women in all the curriculums studied could be differentiated at statistically significant levels, but only for those in Business and Music could the description use more information than the levels of performance in high school.

Chapter VI

Comparisons of Achievement Levels of Entering Juniors and Graduating Seniors in Five Teacher Education Curriculums

The feature of Part II of the longitudinal study which makes it more than a refinement and extension of Part I is the addition of a study of educational development of teacher education majors. This chapter and the two which follow present the detailed analyses which were designed to answer three questions.

Do students who are entering juniors or graduating seniors in different teacher education curriculums differ in their level of educational development? (Chapter VI)

Do students who persist differ in their level of educational development from those who do not? (Chapter VII)

Does the level of educational development increase from entering junior to graduating senior? (Chapter VIII)

Chapter II describes in more detail the point of view and the specific tests which were used to measure educational development in the conduct of this phase of the study. Briefly, educational development in this study refers to the level of certain subject matter or subject matter related achievements or skills that schooling generally teaches. In this study, those achievements are measured by five tests, and the names of the tests provide good descriptive labels:

> 1) English Usage Test; 2) Mathematics Usage Test; 3) Natural Science Reading Test; 4) Social Studies Reading Test; 5) Word Usage Test.

The Population and the Plan

To answer the questions posed by this aspect of the study, tests of educational development had to be administered to students early in the first quarter of their junior year and again as late as possible in the last quarter of the senior year. To have sufficiently large numbers in several teacher education majors, juniors entering during two academic years were combined. To test entering juniors in two successive years and to test them again before they graduated, six quarters later, assuming normal progress, required a total of three years.

To accomplish the testing efficiently, the College required all juniors entering in 1960 and 1961 to take the battery of tests, and those expecting to graduate in 1961 and 1962 could not complete their requirements without taking the test battery whether they had taken the battery as juniors or not. This plan for the study yielded three groups for study: 1) those who took the battery as entering juniors and graduating seniors; 2) those who took only the junior battery; and 3) those who took only the senior battery. Included in the latter two groups were those who did not make normal progress, did not persist, or who had atypical attendence patterns for some other reason. During the course of the three year period, the battery of tests were administered in twenty regular testing sessions since the College admits or graduates students in any of the three academic year or two summer quarters. Innumerable extra administrations were necessary because the College required all juniors and seniors to take the tests at the designated times. Students who failed to complete the battery could not continue their registration if they were juniors or complete graduation requirements if they were seniors. These procedures made it possible to gather complete data and the times and frequency of administration made the inconvenience to students minimal. During all administrations, strictest precautions were employed to protect the security of the tests. Interpretations of test results were made available to students through College advisors and counselors.

A maximum effort was made during the period of study to inform students and faculty of the research program. The research staff published a quarterly newsletter for students and faculty to facilitate communication about the project. These "extra" efforts were judged to have contributed significantly to making the test-taking more palatable, and the research actually did generate "genuine" interest in numbers of studies.

The following two sections compare entering juniors first and then graduating seniors in five teacher education curriculums. In the study of educational development, separate analyses for men and women were not conducted.

Comparisons of Entering Juniors

English Usage Achievement. Considering each test separately, the five groups of juniors were compared by using a one-way analysis of variance to detect differences in the means. Table 6.1 presents the means and variances of the distribution of scores on the English Usage Achievement test for the five curriculums.

One of the assumptions underlying the analysis of variance is that the variances of these five groups, though unknown, are still equal. A gross check on whether or not these data satisfy this assumption is provided by the $F_{(max)}$ test statistic. In this case, the value of this statistic is 2.0542, whereas the 5% critical region for five groups using only 60 degrees of freedom is approximately 2.04. Since critical values for this statistic decrease as the degrees of freedom increase, this would imply that the assumption of equality of variances would be rejected in this case. Nevertheless, it was decided to go ahead with the test of equality of means using the analysis of variance since the literature on the subject indicates that the F test is a "robust" test. (Statistical methods are called robust if the inferences are not seriously invalidated by the violation of their assumptions.) The robustness of the F test has been cited frequently in the literature, for example, of Lindquist, Scheffe, and Box, and applies both to Type I and Type II errors.

Table 6.2 presents the analysis of variance for the English Usage Test. The F value is statistically significant beyond the .001 level, indicating that the mean levels of achievement of the five groups are indiced differently. An examination of the means indicates that the group which includes those students majoring in English-Language Arts has a higher mean than the other

Table 6.1 - Means and Variances of the English Usage Achievement Test Scores of Juniors Entering Five Teacher Education Curriculums

	Elem	Eng-LA	Math	Nat Sci	Soc St
N	472	98	59	52	88
Mean	48.156	56.21	49.73	47.52	48.84
Variance	87.4032	44.8505	92.1321	82.8035	70.9629

Table 6.2 - Analysis of Variance of the English Usage Achievement Test Scores of Juniors Entering Five Teacher Education Curriculums

S.V.	df	SS	MS	F
Between Curriculums	4	5506.950	1376.737	17.17**
Within Curriculums	764	61257.828	80.18	
Total	768	66764.788		

**Significant beyond the .001 level.

Table 6.3 - Distribution of the English Usage Achievement Test Scores of Juniors Entering Five Teacher Education Curriculums

Test	Elementary		Eng-LA		Mathematics		Nat Sci		Soc St	
Scores	freq	cum %	freq	cum %	freq	cum %	freq	cum %	freq	cum %
67-69	4	100.00	4	100.00						
64-66	12	99.15	10	95.92	2	100.00	1	100.00	1	100.00
61-63	32	96.61	10	85.71	4	96.61	3	98.08	5	98.86
58-60	29	89.83	22	75.51	11	89.83	5	92.31	6	93.18
55-57	47	83.69	17	53.06	5	71.19	6	82.69	10	86.36
52-54	55	73.73	11	35.71	6	62.71	4	71.15	19	75.00
49-51	64	62.08	12	24.49	5	52.54	5	63.46	7	53.41
46-48	48	48.52	4	12.24	8	44.07	3	53.85	10	45.05
43-45	57	38.35	4	8.16	3	30.51	4	48.08	9	34.09
40-42	39	26.27	3	4.08	4	25.42	10	40.38	8	23.86
37-39	27	18.01	1	1.02	4	18.64	4	21.15	4	14.77
34-36	32	12.29			4	11.86	5	13.46	7	10.23
31-33	10	5.51			1	5.08	2	3.85	0	2.27
28-30	7	3.39			2	3.39			1	2.27
25-27	5	1.91							1	1.14
22-24	1	.85								
19-21	1	.64								
16-18	1	.42								
13-15	0	.21								
10-12	1	.21								
N	472		98		59		52		88	
$\bar{X}$		48.150		56.122		49.644		47.346		48.773
sd		9.34		6.69		9.60		9.10		8.42

four groups taken separately or combined. The other four groups do not differ among themselves on the mean of the English Usage test. English-Language Arts majors would be expected to show the mean differences reported above in view of the fact that the test was an English Usage test. However, this fact raises the question of whether a ceiling effect may be operating. Such apparently was not the case, since the total number of items in the test was 76 and the highest score achieved by a member of this group was 69.

The distributions shown in Table 6.3 indicate that the Natural Science, Mathematics, Elementary, and Social Studies curriculums were not differentiated by this test. The English-Language Arts majors were clearly superior on this test. In fact, the 25th percentile point for the English-Language Arts majors corresponds roughly to the 52nd percentile point for the Mathematics majors, to the 60th percentile point for the Social Studies majors, the 64th percentile point for the Elementary majors, and the 66th percentile point for the Natural Science majors. In other words, half to two-thirds of the latter groups do as well as three-fourths of the English-Language Arts majors or conversely, only one-fourth of the English-Language Arts majors do as poorly as half of the people in each of the other four groups. The distribution of scores for the English-Language Arts majors is skewed positively, exhibits much less variability, and has a shorter range than the other four groups. Though some students in the Elementary group scored as well on this test as some students in the English-Language Arts group, the Elementary range is nearly twice as great as the English-Language Arts range. Nearly 12% of the Elementary group fell below the lowest score in the English-Language Arts group, and this same situations prevails in the other three groups when compared with the English-Language Arts group.

In short, the English-Language Arts majors achieved a significantly higher mean score and showed less variability than the other four groups included in this study. The English-Language Arts majors maintained their superiority throughout the entire distribution of scores. The other four groups did not differ from each other in any systematic manner.

Mathematics Usage Achievement. Table 6.4 presents the means and variances for the five groups of juniors on the Mathematics Usage Achievement test. Even though the ratio of the largest to the smallest of the variances indicates differences among them, the one-way analysis of variance was used to detect differences among the means of the five distributions of scores. The results of this analysis are given in Table 6.5

The significant F value indicates that differences do exist among these means, and a further analysis of differences between means indicates that the Mathematics majors achieved a higher mean than any other group. The Natural Science majors achieved a higher mean score than the Social Studies, English-Language Arts, and Elementary majors; and the Elementary majors have a lower mean score than the English-Language Arts and Social Studies majors whose mean scores do not differ, i.e.:

$$\text{ELEM} < \text{ENG} = \text{SS} < \text{NS} < \text{M}$$

Table 6.6 shows the differences between the groups on this test in detail. The Mathematics group shows a striking superiority. In fact, about

Table 6.4 - Means and Variances of the Mathematics Usage Achievement Test Scores of Juniors Entering Five Teacher Education Curriculums

	Elem	Eng-LA	Math	Nat Sci	Soc St
N	472	98	59	52	88
Mean	14.75	17.27	32.54	24.77	18.10
Variance	25.2134	36.9186	16.2180	64.4947	40.299

Table 6.5 - Analysis of Variance of the Mathematics Usage Achievement Test Scores of Juniors Entering Five Teacher Education Curriculums

S.V.	df	SS	MS	F
Between Curriculums	4	19715.6758	4928.9189	162.366**
Within Curriculums	764	23192.5479	30.3567	
Total	768	42908.2237		

** Significant beyone the .001 level.

Table 6.6 - Distribution of the Mathematics Usage Achievement Test Scores of Juniors Entering Five Teacher Education Curriculums

Test	Elementary		Eng-LA		Mathematics		Nat Sci		Soc St	
Scores	freq	cum %	freq	cum %	freq	cum %	freq	cum %	freq	cum %
39-40					2	100.00	1	100.00		
37-38					10	96.61	6	98.08	1	100.00
35-36					11	79.66	0	86.54	0	98.86
33-34					8	61.02	4	86.54	1	98.86
31-32			2	100.00	9	47.46	3	78.85	0	97.73
29-30	1	100.00	3	97.96	9	32.20	5	73.08	2	97.73
27-28	6	99.79	5	94.90	6	16.95	3	63.46	3	95.45
25-26	16	98.52	7	89.80	3	6.78	3	57.69	4	92.05
23-24	15	95.13	3	82.65	0	1.69	3	51.92	12	87.50
21-22	24	91.95	5	79.59	1	1.69	6	46.15	9	73.86
19-20	35	86.86	13	74.49			2	34.62	11	63.64
17-18	57	79.45	10	61.22			8	30.77	9	51.14
15-16	69	67.37	15	51.02			5	15.38	8	40.91
13-14	88	52.75	10	35.71			2	5.77	10	31.82
11-12	79	34.11	12	25.51			1	1.92	7	20.45
9-10	36	17.37	9	13.27					5	12.50
7-8	25	9.75	3	4.08					5	6.82
5-6	13	4.45	1	1.02					1	1.14
3-4	8	1.69								
N	472		98		59		52		88	
$\bar{X}$	14.7161		17.2755		32.6186		24.3846		18.0909	
sd	5.02		6.07		4.02		8.03		6.34	

75% of the people in the Mathematics group did better than all of the Elementary people and better than about 95% of the English-Language Arts and Social Studies groups. The 25th percentile point for the Mathematics group is the 68th percentile point for the Natural Science majors. This marked difference between the Mathematics majors and the other four groups leads one to suspect that there is a ceiling effect operating, and data from Table 6.6 support this conclusion. While only two people out of a sample of 50 Mathematics majors received a perfect score of 40 on this test, over half of these people got seven or fewer items wrong. The distribution of scores for the Mathematics group shows an obvious positive skewness and a very small variance. This clearly is not a test that can distinguish among Mathematics majors. An entirely different picture is presented in Table. 6.6 for the Natural Science majors. This group has the largest variance of the five groups and very little clustering is evident. While the 75th percentile point for the Natural Science majors is higher than the other three majors (excepting the Mathematics group), the inter-quartile range is about 15 units long with the median very near the center, indicating a near symmetric distribution with the mean only slightly above the median. The test does seem to be able to distinguish very well among Natural Science majors.

The Social Studies and English-Language Arts distributions are nearly the same for comparison purposes. The two top scores in the Social Studies group tend to elevate the mean score for this group, and without these two scores, the means of the two distributions would be the same. However, compared to the Mathematics majors, nearly 80% of the English-Language Arts majors fall below the lowest score of the mathematic distribution. Nearly 90% of the Social Studies group fall below this point even though some Social Studies majors received a near perfect score on the test.

The Elementary majors score lowest on this test with some getting as few as three items correct. Almost 100 percent of these people fall below the entire mathematic distribution, though there does not seem to be any indication of negative skewness in this group.

In summary, these data show pronounced differences among these groups on the Mathematics Usage Achievement test. The Mathematics majors were superior as one would expect, with Natural Science majors not far behind. The English-Language Arts and Social Studies majors did not differ from each other but achieved significantly below the Mathematics and Natural Science groups, while the Elementary majors were the lowest achieving in this area.

Natural Science Reading Achievement. Table 6.7 includes the five means and five variances of the distributions of scores on the Natural Science Reading Achievement test. The analysis of these means is presented in Table 6.8 and indicates there are significant differences among them.

The analyses of mean differences shows that the Mathematics majors did not differ from the Natural Science majors, nor did the English-Language Arts majors differ from the Social Studies majors. However, the Mathematics majors and Natural Science majors achieved a higher mean score than the English-Language Arts and Social Science majors. All four of these groups have a higher mean score than the Elementary majors, i.e.,

ELEM < ENGLISH-LANGUAGE ARTS = SOCIAL SCIENCE < MATHEMATICS-NATURAL SCIENCE

Table 6.7 - Means and Variances of the Natural Science Achievement Test Scores of Juniors Entering Five Teacher Education Curriculums

	Elem	Eng-LA	Math	Nat Sci	Soc St
N	472	98	59	52	88
Mean	26.95	30.94	33.46	33.69	30.26
Variance	41.8067	41.2952	43.3904	58.7270	51.8734

Table 6.8 - Analysis of Variance of the Natural Science Achievement Test Scores of Juniors Entering Five Teacher Education Curriculums

S.V.	df	SS	MS	F
Between Curriculums	4	4770.2202	1192.555	27.0189**
Within Curriculums	764	33721.3169	44.1378	
Total	768	38491.5371		

**Significant beyond the .001 level.

Table 6.9 - Distribution of the Natural Science Achievmement Test Scores of Juniors Entering Five Teacher Education Curriculums

Test	Elementary		Eng-LA		Mathematics		Nat Sci		Soc St	
Scores	freq	cum %	freq	cum %	freq	cum %	freq	cum %	freq	cum %
47-48									1	100.00
45-46					1	100.00	2	100.00	0	98.86
43-44	1	100.00	2	100.00	4	98.31	2	96.15	0	98.86
41-42	11	99.79	3	97.96	6	91.53	6	92.31	2	98.86
39-40	5	97.46	6	94.90	2	81.36	8	80.77	3	96.59
37-38	16	96.40	10	88.78	6	77.97	4	65.38	7	93.18
35-36	24	93.01	9	78.57	6	67.80	3	57.69	14	85.23
33-34	35	87.92	15	69.39	9	57.63	7	51.92	13	69.32
31-32	43	80.51	10	54.08	8	42.37	4	38.46	8	54.55
29-30	56	71.40	10	43.88	7	28.81	5	30.77	10	45.45
27-28	62	59.53	8	33.67	3	16.95	2	21.15	6	34.09
25-26	58	46.40	7	25.51	2	11.86	1	17.31	6	27.27
23-24	49	34.11	7	18.37	1	8.47	3	15.38	8	20.45
21-22	41	23.73	5	11.22	1	6.78	2	9.62	3	11.36
19-20	27	15.04	3	6.12	2	5.08	1	5.77	2	7.95
17-18	16	9.32	1	3.06	0	1.69	0	3.85	0	5.68
15-16	12	5.93	1	2.04	1	1.69	1	3.95	2	5.68
13-14	8	3.39	1	1.02			1	1.92	1	3.41
11-12	5	1.69							0	2.27
9-10	2	.64							0	2.27
7-8	1	.21							1	2.27
5-6									1	1.14
N	472		98		59		52		88	
$\bar{X}$		26.97	30.9286		33.5338		33.6538		30.2045	
sd		6.46	6.43		6.58		7.66		7.20	

Table 6.9 is included as a more detailed presentation of the five distributions on this test. The similarity between the English-Language Arts group and the Social Studies group is clearly shown, as is the difference between the four academic groups and the group of Elementary majors. When comparing the distribution for the Elementary majors with those of the English-Language Arts and Social Studies majors, the 50th percentile point for the latter two groups corresponds to the 75th percentile point for the Elementary group. The 75th percentile point for the Elementary group corresponds to the 32nd percentile point for the Mathematics and Natural Science majors.

In other words, nearly half of the English-Language Arts and Social Studies people do better than three-fourths of the Elementary people; and nearly three-fourths of the Mathematics and Natural Science majors achieve higher scores on this test than three-fourths of the Elementary majors. Similarly, nearly half of the Mathematics and Natural Science majors achieve higher scores than three-fourths of the English and Social Studies majors. The similarity of the Mathematics and Natural Science majors is perhaps explained by the fact that many Mathematics majors minor in one of the Natural Sciences, but the reverse is not necessarily true. Natural Science majors do not tend to minor in Mathematics. The usual pattern is for majors in the Physical Sciences, either chemistry or physics, to minor in Mathematics. Those majoring in Natural Science do not minor in Mathematics but elect a pattern of Natural Science and Physical Science courses. The Natural Science group used in this study included both Physical Science and Natural Science majors. These considerations would tend to make the Mathematics majors imilar to the Natural Science majors on a Natural Science test while the reverse would not necessarily be true on a Mathematics test because of the attenuation in Mathematics skill caused by the Natural Science majors who have not had recent training in Math.

The distributions shown in Table 6.9 indicate that no person in any major received a perfect score (51) on this Natural Science Reading test. In fact, the highest score was achieved by a major in the Social Studies curriculum, and also, the lowest score was achieved by a major in this same curriculum. If the top and the two bottom scores of the Social Studies curriculum were omitted, the English and Social Studies distributions would be almost identical and the percentages for these two distributions would be very similar to the Natural Science and therefore, the Mathematics distributions. This would suggest that the English-Language Arts and Social Studies people were as well versed in the area of Natural Science as those who concentrated on Natural Science courses in college. The test, however, emphasized the ability to comprehend paragraphs about Natural Science topics; and did not specifically test for factual knowledge from Natural Science areas where Natural Science majors or minors would be expected to excel. This emphasis on comprehension perhaps accounts in part for the similarity of the Natural Science, English-Language Arts, Social Studies majors. The people in these latter two groups can use their verbal facility to "shore up" their knowledge of Natural Science in this test. On the other hand, the Science majors may be handicapped on the test because of its emphasis on language skills, an area where they did not show excellence as indicated in the English Usage test above.

In summary, the Natural Science Reading test distinguished between

Elementary and academic majors. Within the academic majors, this test did not separate English-Language Arts and Social Studies majors, nor did it distinguish between Mathematics and Natural Science majors. However, it did differentiate English-Language Arts and Social Studies majors from Mathematics and Natural Science majors.

Social Studies Reading Achievement. Table 6.10 presents the means and variances for the five major groups on the Social Studies Reading Achievement test. The analysis of variance was used to detect differences among these means, and the results are presented in Table 6.11 and again indicates, statistically, that differences do exist. A subsequent analysis of mean differences shows that the five majors fall into three sets. The Social Studies and English-Language Arts majors achieve mean scores which do not differ statistically but are higher than those achieved by the Mathematics and Natural Science majors, which do not differ from each other. The Elementary majors achieve a lower mean score than all four of the academic majors.

Table 6.12 is included to present a detailed picture of these five distributions. The distributions show that the Social Studies majors did maintain a slight superiority over the English majors throughout most of the distribution of scores, overlap occurring only at either extreme. However, the similarity of the distributions of all four academic majors is noticeable while the Elementary majors consistently fall below the other four groups with nearly three-fourths of the Elementary people scoring below three-fourths of the Social Studies majors. The English-Language Arts and Social Studies majors both have one person very low on the distribution of scores. Both of these groups would have higher mean scores if these extraordinary scores were removed. The separation between these two groups and the Mathematics and Natural Science would then be more pronounced.

The Social Studies majors tend to cluster toward the top of the distribution of observed scores on the Social Studies test. This tendency for people to achieve high scores on a test of their major area of concentration was noticed with the other tests, the only notable exception being the Natural Science Reading test. However, the Mathematics test was the only one where a serious ceiling effect seemed apparent. This Social Studies test does seem to show slight ceiling effects because of a total of 51 items, the highest score obtained in this group was 48. However, the highest score observed was obtained by an English-Language Arts major, not a Social Studies major, and a Mathematics major did as well as the highest scores in the Social Studies group.

In summary, the English-Language Arts and Social Studies majors were not distinguished by this test, neither were Mathematics and Natural Science majors. However, English and Social Studies majors did perform better than Mathematics and Natural Science majors and better than Elementary majors. Furthermore, all academic majors performed better on this Social Studies Reading test than Elementary majors.

Word Usage Achievement. Means and variances of the Word Usage Achievement test distributions for the five curriculum groups are given in Table 6.13. The analysis of variance is presented in Table 6.14, and indicates that there are differences among the mean scores achieved by using these five groups.

Table 6.10 - Means and Variances of the Social Studies Reading Achievement Test Scores of Juniors Entering Five Teacher Education Curriculums

	Elem	Eng-LA	Math	Nat Sci	Soc St
N	472	98	59	52	88
Mean	31.	37.12	35.25	34.23	38.07
Variance	47.1231	31.8199	47.4342	47.4751	36.8459

Table 6.11 - Analysis of Variance of the Social Studies Reading Achievement Test Scores of Juniors Entering Five Teacher Education Curriculums

S.V.	df	SS	MS	F
Between Curriculums	4	6085.1682	1521.2920	34.5301**
Within Curriculums	764	33659.5133	44.0569	
Total	768	39744.6815		

** Significant beyong the .001 level.

Table 6.12 - Distribution of the Social Studies Reading Achievement Test Scores of Juniors Entering Five Teacher Education Curriculums

Test	Elementary		Eng-LA		Mathematics		Nat Sci		Sco St	
Scores	freq	cum %	freq	cum %	freq	cum %	freq	cum %	freq	cum %
49-50			1	100.00						
47-48			2	98.98	1	100.00			2	100.00
45-46	2	100.00	3	96.94	1	98.31	3	100.00	5	97.73
43-44	16	99.58	10	93.88	5	96.61	3	94.23	9	92.05
41-42	24	96.19	10	83.67	6	88.14	4	88.46	20	81.82
39-40	30	91.10	16	73.47	10	77.97	7	80.77	13	59.09
37-38	31	84.75	14	57.14	6	61.02	5	67.31	13	44.32
35-36	51	78.18	13	42.86	8	50.85	4	57.69	6	29.55
33-34	46	67.37	13	29.59	4	37.29	5	50.00	8	22.73
31-32	58	57.63	3	16.33	3	30.51	5	40.38	6	13.64
29-30	58	45.34	4	13.27	4	25.42	4	30.77	0	6.82
27-28	41	33.05	5	9.18	3	18.64	2	23.08	1	6.82
25-26	36	24.36	3	4.08	3	13.56	6	19.23	2	5.68
23-24	25	16.74	0	1.02	3	8.47	1	7.69	1	3.41
21-22	19	11.44	0	1.02	1	3.39	3	5.77	1	2.27
19-20	12	7.42	0	1.02	0	1.69			0	1.14
17-18	8	4.87	0	1.02	0	1.69			0	1.14
15-16	9	3.18	1	1.02	0	1.69			0	1.14
13-14	5	1.27			1	1.69			0	1.14
11-12	1	.21							0	1.14
9-10									1	1.14
N	472		98		59		52		88	
$\overline{X}$	31.0466		36.5102		35.1610		34.1923		38.0455	
sd	6.86		5.64		6.88		6.89		6.07	

Table 6.13 - Means and Variances of the Word Usage Achievement Test Scores of Juniors Entering Five Teacher Education Curriculums

	Elem	Eng-LA	Math	Nat Sci	Soc St
N	472	98	59	52	88
Mean	64.06	73.5306	65.4576	68.8077	69.2955
Variance	83.9238	33.5094	105.6318	125.6094	50.4634

Table 6.14 - Analysis of Variance of the Word Usage Achievement Test Scores of Juniors Entering Five Teacher Education Curriculums

S.V.	df	SS	MS	F
Between Curriculums	4	8642.861	2160.7152	27.6506**
Within Curriculums	764	59701.540	78.1433	
Total	768	68344.401		

**Significant beyond the .001 level.

Table 6.15 - Distribution of the Word Usage Achievement Test Scores of Juniors Entering Five Teacher Education Curriculums

Test	Elementary		Eng-LA		Mathematics		Nat Sci		Soc St	
Scores	freq	cum %	freq	cum %	freq	cum %	freq	cum %	freq	cum %
84-86	1	100.00	1	100.00			2	100.00		
81-83	4	99.79	10	98.98	1	100.00	6	96.15	2	100.00
78-80	18	98.94	13	88.78	6	98.31	5	84.62	8	97.73
75-77	32	95.13	20	75.51	7	88.14	6	75.00	12	88.64
72-74	56	88.35	28	55.10	5	76.27	5	63.46	14	75.00
69-71	53	76.48	10	26.53	4	67.80	6	53.85	17	59.09
66-68	57	65.25	7	16.33	8	61.02	6	42.31	13	39.77
63-65	64	53.18	4	9.18	7	47.46	4	30.77	7	25.00
60-62	47	39.62	4	5.10	5	35.59	0	23.08	4	17.05
57-59	44	29.66	0	1.02	6	27.12	5	23.08	8	12.50
54-56	32	20.34	0	1.02	4	16.95	2	13.46	1	3.41
51-53	24	13.56	0	1.02	2	10.17	2	9.62	1	2.27
48-50	14	8.47	1	1.02	1	6.78	1	5.77	1	1.14
45-47	10	5.51			1	5.08	0	3.85		
42-44	13	3.39			1	3.39	0	3.85		
39-41	2	.64			0	1.69	0	3.85		
36-38	0	.21			0	1.69	2	3.85		
33-35	1	.21			0	1.69				
30-32					1	1.69				
N		472		98		59		52		88
$\bar{X}$		64.0381		73.6122		65.4746		68.9038		69.3523
sd		9.16		5.78		10.27		11.21		7.10

Subsequent analysis of mean differences using Scheffe's S method indicates that the five means fall into two sets. The English-Language Arts, the Natural Science, and the Social Studies majors achieved mean scores that do not differ statistically. The Elementary and Mathematics majors fall into another set composed of the other three groups. The fact that the Natural Science majors did as well on the test as the English-Language Arts majors is of interest, as is the fact that the Elementary majors did as well as the Mathematics majors. There is no separation between Elementary and academic curriculums on this test, and there is no separation within the academic curriculums.

The distributions for these five groups on this test are given in Table 6.15, and here the similarity between the Mathematics and Elementary majors is again evident. The only marked differences occur at the upper end of the distribution, where Mathematics majors tend to be more like Social Studies than Elementary majors. That is, if differences were sought only in the upper score range, say from 65-88, the pattern of mean equalities would put the Mathematics and Social Studies majors together, the Natural Science and English-Language Arts majors together, and the Elementary majors would be alone and below the academic curriculums. A different picture is found in the low score ranges. Using the English-Language Arts majors as a reference point, 92% of the Elementary majors fall below half of the English-Language Arts majors, while about three-fourths of the Mathematics and Social Studies majors fall below half of the English-Language Arts majors. There is one very low score in the Mathematics group which tends to pull the mean down but even without this single aberrant score, the Mathematics and Elementary means would differ little.

Of considerable interest, are the score distributions of the English-Language Arts, Social Studies, and Natural Science majors. These present two different kinds of pictures. The test included 88 items, and while no one received a perfect score, there was considerable clustering near the top of the distribution in the English-Language Arts and Social Studies groups. These two distributions are skewed, and if the single low observation in the English-Language Arts group were missing, the skewness here would be even more pronounced. On the other hand, the Natural Science majors are spread out over a larger range of scores with no obvious skewness in the distribution. Even omitting the two low scores from this distribution would not alter the pattern of scores though it would probably raise the mean. Given more room at the top of this test, one might expect some English-Language Arts and Social Studies majors to move higher up on the score continuum while the Natural Science majors would not tend to spread out. In other words, the similarity between these three majors may be a function of the test and not due to inherent similarities of these major groups in this area of knowledge.

In summary, the mean scores of the five curriculums on the Word Usage test were found to be different. The English-Language Arts, Social Studies, and Natural Science majors performed equally well on this test. These three major groups performed significantly better than the Elementary and Mathematics majors whose mean scores did not differ.

Comparisons of Graduating Seniors

English Usage Achievement. Means and variances of the five distributions of scores on the English Usage Achievement test taken by seniors are presented in Table 6.16. Since the variances are not sufficiently different to invalidate the results, a one-way analysis of variance was used to detect differences among the mean scores of the five curriculum groups. The results of the analysis are presented in Table.6.17.

The significant F value indicates that differences do exist, and a subsequent study of mean differences yielded the following pattern: the English-Language Arts majors achieved a higher mean score than all the other four groups, while the means for the Mathematics, Natural Science, Elementary and Social Studies do not differ. This results is not surprising since the test covers English usage. However, recalling from the discussion of these tests taken in the junior year that the Elementary curriculum tended to be separated and usally was below the secondary curriculums with respect to mean scores, it was of interest to see if the same situation prevailed at the senior year level. Therefore, the difference between the mean score on this test for the Elementary majors and the average of the mean scores for the four groups of Secondary majors was tested to see if it differed significantly from zero. The confidence interval obtained by the S method and set at the 5% level did include zero. Thus, one could conclude that the Elementary and Secondary curriculums considered here do not differ in English Usage as measured by this test.

It was also of interest to see if, within the four secondary curriculums, there might be a difference between the average of the means of the two curriculums which emphasize verbal skills and the average of the means of the two curriculums which emphasize numerical and/or new verbal skills. Thus, the English-Language Arts and the Social Studies majors were compared to the Mathematics and Natural Science majors. The resulting confidence interval included zero so one may conclude that those people majoring in the numerical and scientific areas were, at least on the average, as adept in the use of basic English usage, grammar, punctuation, and so forth, as those who choose to concentrate in the more verbal areas. Contrary results would have been cause for concern if one has accepted the value judgment that all teachers should possess basic communication skills.

Table 6.18 is presented to give a more detailed picture of the distributions on this test. These distributions show the superiority of the English-Language Arts majors on this test throughout the entire score continuum. In fact, the 50th percentile for the English-Language Arts majors corresponds to, at least, the 80th percentile on the other majors. Table 6.18 shows one strikingly deviant score in the English-Language Arts group. The single person who fell in the score interval of 13-15 was investigated and there was sufficient reason to believe that her scores on all tests were not valid measures of ability in the area. Suspicion was aroused because the English-Language Arts major has consistently been the one with the smallest variance and highest mean on the English test, where here the English-Language Arts major has the largest variance. If the single deviant observation was discarded, the variance and mean of this distribution are 35.542 and 61.5. A drastic change occurs in the variance. Omitting this low score, the clustering of the English-Lanaguage Arts people near the top of the distribution is quite evident, though none of these people achieved a perfect score of 76 on this test. The rest of the distributions do not show this marked clustering but seem to be quite similar to each other as was indicated by the ANOVA.

Table 6.16 - Means and Variances of the English Usage Achievement Test Scores of Graduating Seniors in Five Teacher Education Curriculums

	Elem	Eng-LA	Math	Nat Sci	Soc St
N	309	65	42	29	46
Mean	53.73	60.71	54.90	51.21	55.17
Variance	77.7266	69.0851	87.5053	53.8128	85.8802

Table 6.17 -Analysis of Variance of the English Usage Achievement Test Scores of Graduating Seniors in Five Teacher Education Curriculums

S.V.	df	SS	MS	F
Between Curriculums	4	3001.0127	750.25317	10.106**
Within Curriculums	486	36081.1380	74.24102	
Total	490	39082.1507		

**Significant beyond the .001 level.

Table 6.18 - Distribution of the English Usage Achievement Test Scores of Graduating Seniors in Five Teacher Education Curriculums

Test	Elementary		Eng-LA		Mathematics		Nat Sci		Soc St	
Scores	freq	cum %	freq	cum %	freq	cum %	freq	cum %	freq	cum %
70-72	2	100.00	2	100.00						
67-69	9	99.30	11	96.72	1	100.00			1	100.00
64-66	22	96.15	13	78.69	4	97.56	1	100.00	4	97.56
61-63	33	88.46	12	57.38	6	87.80	2	96.15	9	87.80
58-60	38	76.92	9	37.70	9	73.17	4	88.46	9	65.85
55-57	43	63.64	6	22.95	7	51.22	3	73.08	4	43.90
52-54	36	48.60	3	13.11	5	34.15	4	61.54	4	34.15
49-51	29	36.01	0	8.20	2	21.95	2	46.15	3	24.39
46-48	24	25.87	3	8.20	2	17.07	2	38.46	4	17.07
43-45	17	17.48	1	3.28	2	12.20	5	30.77	2	7.32
40-42	18	11.54	0	1.64	2	7.32	2	11.54	1	2.44
37-39	7	5.24	0	1.64	0	2.44	1	3.85		
34-36	1	2.80	0	1.64	1	2.44				
31-33	5	2.45	0	1.64						
28-30	0	.70	0	1.64						
25-27	0	.70	0	1.64						
22-24	1	.70	0	1.64						
19-21	0	.35	0	1.64						
16-18	1	.35	0	1.64						
13-15			0	1.64						
N	286		61		41		26		41	
$\overline{X}$	53.6818		60.7213		55.7804		51.5000		56.5853	
sd	8.6794		8.5739		7.1993		7.6057		6.7925	

In summary, the English-Language Arts majors achieved a higher mean score on the English Usage test than did the other four majors. This test did not differentiate among the Mathematics, Natural Science, Social Studies, and Elementary majors. It did not differentiate between Secondary and Elementary curriculums, nor did it separate Secondary curriculums emphasizing verbal skills from those which do not rely primarily on this ability.

Mathematics Usage Achievement. Means and variances on the Mathematics Usage Achievement test administered during the senior year are presented in Table 6.19. The smallest variance is approximately three times the largest. However, the robustness of the analysis of variance was again relied upon. The results of this analysis are presented in Table 6.20 where the significant F values indicates a difference among the five means.

The differences are certainly not surprising since visual inspection alone would have led one to this conclusion. More useful information comes from an analysis of what means among the five differ from each other. Accordingly, the S method at the 5% level was used to examine mean differences. The people in the Mathematics majors achieved a significantly higher mean score than the four other majors. Further examination by the S method indicates that Natural Science majors achieved a higher mean score than those majoring in the Elementary, English-Language Arts, and Social Studies curriculums. The Social Studies majors achieved a mean score significantly higher than the Elementary majors. The English-Language Arts and Social Studies majors achieved mean scores which are statistically equal as are the mean scores of the English-Language Arts and Elementary majors. The S method of Scheffe is not designed to order these means on a single dimension. Therefore, the apparent contradiction where the Social Studies mean is "equal" to the English-Language Arts mean and greater than the Elementary mean; while the English-Language Arts mean is not different from the Elementary mean is understandable.

Comparing the mean of the Elementary majors with the average mean of the four Secondary majors, one finds that the latter are signficantly higher while within the Secondary majors, the average of the mean scores of the Mathematics and Natural Science majors is higher than the average of the mean score of the English-Language Arts and Social Studies majors. Also, the Elementary mean is statistically smaller than the average of the mean score for the English-Language Arts and the Social Studies majors.

Table 6.21 presents the frequency distributions for these five groups on this test of mathematics Usage. The table shows the marked superiority of the Mathematics group over the other four majors. The marked skewness of the distribution of scores in the Mathematics curriculum is especially evident, with nearly half of the people in this group receiving a score which differs from a perfect score (40) by, at most, three points. The test is certainly not appropriate for differentiating among Mathematics majors. In fact, its reliability should be very low for this group. On the other hand, it seems to be remarkably effective in separating Mathematics majors from the other four majors. Comparing percentile points, one finds that nearly 95% of the Mathematics majors do better on this test than at least 90% of those people majoring in English-Language Arts, Social Studies, and Elementary curriculums. The fifth percentile point for the Mathematics majors corresponds to approximately the 50th percentile point for the Natural Science majors.

Table 6.21 shows that a considerable number of Elementary majors had low

Table 6.19 - Means and Variances of the Mathematics Usage Achievement Test Scores of Graduating Seniors in Five Teacher Education Curriculums

	Elem	Eng-LA	Math	Nat Sci	Soc St
N	309	65	42	29	46
Mean	17.22	18.72	35.05	28.69	20.70
Variance	27.6119	34.9221	18.2416	55.3645	46.8387

Table 6.20 - Analysis of Variance of the Mathematics Usage Achievement Test Scores of Graduating Seniors in Five Teacher Education Curriculums

S.V.	df	SS	MS	F
Between Curriculums	4	14220.1766	3555.0441	114.078**
Within Curriculums	486	15145.3387	31.1633	
Total	490	29365.5153		

**Significant beyond the .001 level.

Table 6.21 - Distribution of the Mathematics Usage Achievement Test Scores of Graduating Seniors in Five Teacher Education Curriculums

Test	Elementary		Eng-LA		Mathematics		Nat Sci		Soc St	
Scores	freq	cum %	freq	cum %	freq	cum %	freq	cum %	freq	cum %
39-40					11	100.00	3	100.00		
37-38					11	73.18	2	88.46	1	100.00
35-36					6	46.34	2	80.77	1	97.56
33-34	2	100.00	1	100.00	0	31.71	1	73.08	0	95.12
31-32	0	99.30	1	98.36	7	31.71	2	69.23	1	95.12
29-30	4	99.30	2	96.72	4	14.63	2	61.54	3	92.68
27-28	10	97.90	2	93.44	2	4.88	1	53.85	1	85.37
25-26	12	94.41	5	90.16			3	50.00	4	82.93
23-24	15	90.21	7	81.97			1	38.46	2	73.17
21-22	27	84.97	2	70.49			5	34.62	5	68.29
19-20	40	75.52	9	67.21			2	15.38	6	56.10
17-18	30	61.54	6	52.46			1	7.69	6	41.46
15-16	57	51.05	14	42.62			1	3.85	3	26.83
13-14	32	31.12	3	19.67					3	19.51
11-12	34	19.92	5	14.75					2	12.20
9-10	15	8.04	3	6.56					3	7.32
7-8	6	2.80	0	1.64						
5-6	2	.70	1	1.64						
N	286		61		41		26		41	
$\overline{X}$	17.164		18.745		35.451		27.961		20.524	
sd	5.1841		5.9725		3.8339		7.4726		6.7956	

scores on this test. Also, many English-Language Arts and Social Studies majors like far down on score continuum. In fact, the mode of the English-Lanaguage Arts majors and the Elementary majors falls in the same score interval. In both of these curriculums, there are some people who do very well on this test but very few approach the level of performance of even the lowest scoring Mathematics major. The distribution of Social Studies majors has approximately the same range as the English-Language Arts and Elementary majors, but the distribution is located slightly higher on the continuum than the latter two distributions. The Natural Science distribution is very nearly rectangular, probably reflecting the small sample size. The small sample is also reflected in the large standard deviation.

To summarize the results of this test, the Mathematics majors achieve a higher mean score than any other major group. They have a remarkably small variance and a decidedly positive skewed distribution. The Natural Science majors achieve a higher mean score than the English-Language Arts, Elementary, or Social Studies majors, but they have the largest standard deviation. The Social Studies and the English-Language Arts majors perform about equally well on this test. The Elementary majors do as well as the English-Language Arts majors but not as well as the Social Studies majors.

Natural Science Reading Achievement. Table 6.22 presents the means and variances for the scores of five groups of seniors who took the Natural Science Reading Achievement test. From an inspection of the means, the Elementary majors mean score seems to be the only one that departs markedly from the rest of the mean scores, while the distribution of scores obtained from the Social Studies majors has the largest variance. Following the same plan as for other tests, a one-way analysis of variance was performed to test for statistical equality of these five means. The results of this analysis are presented in Table 6.23 and the significant F value indicates that the hypothesis of equal means would be rejected at least at the .001 level.

In order to discover which means among the five are different and therefore contribute to the observed difference, Scheffe's S method was used for contrasts between all pairs of means. The mean score of the Elementary major group was found to be significantly different from the other four means, all of which were not statistically different.

In checking for further mean differences which might be accounting for the significant F value, no difference was found between the average of the mean scores of the Natural Science and Mathematics majors when compared to the average of the mean scores for the Social Studies and the English-Language Arts majors. That is, those people majoring in curriculums which seem to emphasize numerical and/or scientific skills did no better on a test of ability to comprehend reading material dealing with Natural Science information than those people majoring in curriculums which emphasize verbal and communicative skills. As would be expected from the configuration of differences among pairs of means, those persons majoring in Elementary Education do not achieve as high a mean score as the average of the means for all the four groups majoring in Secondary curriculums.

Table 6.24 presents the five distributions of scores on this Natural Science Reading test. The Natural Science majors fall slightly higher on the percentile distribution than the other curriculums, though there is sufficient overlap in distributions so that only the Elementary group is statistically

Table 6.22 - Means and Variances of the Natural Science Achievement Test Scores of Graduating Seniors in Five Teacher Education Curriculums

	Elem	Eng-LA	Math	Nat Sci	Soc St
N	309	65	42	29	46
Mean	29.31	32.97	34.48	36.90	33.74
Variance	43.4421	41.2803	38.2555	32.7389	55.2193

Table 6.23 - Analysis of Variance of the Natural Science Achievement Test Scores of Graduating Seniors in Five Teacher Education Curriculums

S.V.	df	SS	MS	F
Between Curriculums	4	2989.9614	747.4903	17.306**
Within Curriculums	486	20992.1486	43.19372	
Total	490	23982.1100		

**Significant beyond the .001 level.

Table 6.24 - Distribution of the Natural Science Achievement Test Scores of Graduating Seniors in Five Teacher Education Curriculums

Test	Elementary		Eng-LA		Mathematics		Nat Sci		Soc St	
Scores	freq	cum %	freq	cum %	freq	cum %	freq	cum %	freq	cum %
45-46	2	100.00					1	100.00		
43-44	1	99.65			2	100.00	1	96.15		
41-42	8	99.30	7	100.00	7	95.12	6	92.31	1	100.00
39-40	7	96.50	7	88.52	5	78.05	4	69.23	4	97.56
37-38	15	94.06	6	77.05	4	65.85	4	53.85	5	87.80
35-36	35	88.81	8	67.21	4	56.10	2	38.46	7	75.61
33-34	26	76.57	11	54.10	4	46.34	2	30.77	6	58.54
31-32	34	67.48	8	36.07	3	36.59	2	23.08	5	43.90
29-30	33	55.59	2	22.95	3	29.27	2	15.38	3	31.71
27-28	42	44.06	4	19.67	3	21.95	1	7.69	6	24.39
25-26	22	29.37	4	13.11	4	14.63	0	3.85	2	9.76
23-24	14	21.68	1	6.56	1	4.88	0	3.85	2	4.88
21-22	22	16.78	1	4.92	1	2.44	0	3.85		
19-20	10	9.09	0	3.28			1	3.85		
17-18	7	5.59	0	3.28						
15-16	4	3.15	1	3.28						
13-14	2	1.75	0	1.64						
11-12	2	1.05	1	1.64						
9-10	1	.35								
N		286		61		41		26		41
$\overline{X}$		29.283		33.434		34.475		36.653		32.817
sd		6.4207		6.2330		6.1524		5.7823		4.6340

different throughout the continuum. For example, the 25th percentile, the point below which 25% of the Natural Science majors fall, corresponds to approximately the 40th percentile for the other three Secondary majors, and corresponds to the 72nd percentile point for the Elementary majors. Nearly three-fourths of the Natural Science majors do better on this test than three-fourths of the Elementary majors. In the same manner, the 50th percentile for the English-Language Arts and Social Studies majors corresponds to about the 75th percentile for the Elementary majors. The Mathematics majors also did better on this test than the Elementary majors, but seem quite similar to the English-Language Arts and the Social Studies majors below the 50th percentile and similar to the Natural Science majors **above** the 50th percentile.

The marked skewness that was observed for the English majors on the English Usage test, and the Mathematics majors on the Mathematics Usage test, is noticeably absent for the Natural Science majors on the Natural Science Reading test. This is, in part, due to the small sample size. However, the variance of these scores for Natural Science majors is not as large as one would expect from such a small sample if it were true that sampling errors were accounting for the lack of expected skewness. In fact, if one were to omit the single aberrant response at the bottom of the distribution, the group would be considerably less variable but still not as skewed as the Mathematics majors were on "their" test. One could speculate that the Natural Science majors don't know any more Natural Science than any other major, or alternatively that the test is of such a nature that it does not allow the Natural Science majors to exhibit their unique knowledge about Natural Science, the items being of such a general nature.

In any event, whatever the items are testing, this test does not differentiate between English-Language Arts, Social Studies, Mathematics, or Natural Science majors, though it seems capable of differentiating individuals within each of these majors since the range of scores is fairly large with no serious clustering at any point on the score continuum.

In summary, the hypothesis of equality of means of the five major groups on the Natural Science Reading test was rejected. The Elementary majors achieved a lower mean score than any other curriculum while the mean scores for the four groups of Secondary majors did not differ statistically from each other. However, the frequency distributions for the other four majors are completely contained within the score continuum of the Elementary majors. The test did not differentiate among Secondary curriculums. In particular, it did not separate Natural Science majors from the rest of the Secondary groups.

Social Studies Reading Achievement. Means and variances of the distributions of scores on the Social Studies Reading Achievement test taken by seniors are presented in Table 6.25. The discrepancies among the observed variances were not considered large enough to seriously violate the assumptions of the analysis of variance; therefore, a one-way analysis was used to detect statistical difference amond these five means. The results of this analysis are presented in Table 6.25.

The significant F value in Table 6.26 announces such differences do exist and a subsequent analysis by Scheffe's S method was used to locate these differences. The confidence intervals showed no difference among the four

Table 6.25 - Means and Variances of the Social Studies Reading Achievement Test Scores of Graduating Seniors in Five Teacher Education Curriculums

	Elem	Eng-LA	Math	Nat Sci	Soc St
N	309	65	42	29	46
Mean	33.00	38.08	37.79	36.45	40.78
Variance	47.8993	36.2596	49.5871	54.2562	24.0406

Table 6.26 - Analysis of Variance of the Social Studies Reading Achievement Test Scores of Graduating Seniors in Five Teacher Education Curriculums

S.V.	df	SS	MS	F
Between Curriculums	4	3780.2446	945.0612	21.158**
Within Curriculums	486	21707.6821	44.6660	
Total	490	25487.9267		

**Significant beyond the .001 level.

Table 6.27 - Distribution of the Social Studies Reading Achievement Test Scores of Graduating Seniors in Five Teacher Education Curriculums

Test	Elementary		Eng-LA		Mathematics		Nat Sci		Soc St	
Scores	freq	cum %	freq	cum %	freq	cum %	freq	cum %	freq	cum %
49-50					1	100.00				
47-48	2	100.00	2	100.00	1	97.56			5	100.00
45-46	2	99.30	8	96.72	3	95.12			3	87.80
43-44	10	98.60	3	83.61	6	87.80	4	100.00	8	80.49
41-42	18	95.10	9	78.69	6	73.17	5	84.62	9	60.89
39-40	36	88.81	7	63.93	4	58.54	1	65.38	5	39.02
37-38	34	76.22	10	52.46	6	48.78	3	61.54	6	26.83
35-36	27	64.34	12	36.07	5	34.50	3	50.00	0	12.20
33-34	39	54.90	2	16.39	2	21.95	5	38.46	4	12.20
31-32	22	41.26	4	13.11	1	17.07	1	19.23	1	2.44
29-30	25	33.57	2	6.56	0	14.63	0	15.38		
27-28	23	24.83	0	3.28	2	14.63	1	15.38		
25-26	13	16.78	0	3.28	2	9.76	0	11.54		
23-24	13	12.24	0	3.28	1	4.88	0	11.54		
21-22	13	7.69	0	3.28	0	2.44	2	11.54		
19-20	4	3.15	0	3.28	1	2.44	0	3.85		
17-18	2	1.75	1	3.28			1	3.85		
15-16	2	1.05	0	1.64						
13-14	0	.35	1	1.64						
11-12	0	.35								
9-10	0	.35								
7-8	0	.35								
5-6	1	.35								
N		286		61		41		26		41
$\overline{X}$		33.073		38.090		37.841		36.115		41.060
sd		6.6940		6.1245		6.7632		6.9468		4.2631

Secondary curriculum groups. However, the group majoring in Education achieved a mean score which differed statistically from the mean scores of all Secondary curriculums. The Elementary mean score was less than the other four means, and it was also less than the average of the four mean scores derived from the Secondary curriculum. Within the four groups of people majoring in Secondary curriculums, there was no difference in the average of the mean scores attained by the Mathematics and Natural Science majors when compared to the average of the mean scores of the English-Language Arts and Social Studies majors. That is, the Secondary majors, no matter what the nature of the field of major concentration, performed at approximately the same level on the Social Studies Reading Achievement test. The variances of the four Secondary groups, however, do show some differences, with the Social Studies least variable and the Natural Science group most variable. Though the latter is due largely to the small sample size in the Natural Science curriculum.

Table 6.27 presents these distributions in more detail. The cumulative percentage distributions in Figure 6.9 show that the percentiles for the Social Studies seniors lie above those for all other majors and do so consistently throughout the entire distribution. The 50th percentile point for this group corresponds to the 72nd percentile point for the Mathematics majors, the 78th percentile point for the English-Language Arts majors, the 84th percentile for the Natural Science majors, and the 95th percentile for the Elementary majors. That is, about 50% of the Social Science people did better on a Social Studies Reading test than at least 75% of each of the other groups included in this analysis. The results for the Mathematics and English-Language Arts majors are similar, differing markedly only in the lower end of the score continuum. The small variance of the Social Studies distribution is particularly noticeable. While the scores for the group do not cluster noticeably in any one interval, over 85% of these people fall in intervals covering a range of eleven score points. Two people in the English-Language Arts major scored considerably below the rest of the group; without these two scores, that major group would cover about the same range as the Social Studies majors but with quite a different shaped distribution. The large number of people scoring just at the mean presents a more leptokurtic curve than that seen in the Social Studies distribution. Furthermore, the two low scores in the English-Language Arts group probably lowered the mean scores slightly; and without these two scores, the English-Language Arts and Social Studies groups would have been more similar in terms of the measure of central location as well as in terms of the variance of the distribution of scores.

One person in the Mathematics group scored above both the English-Language Arts or the Social Studies majors, but the whole distribution of Mathematics scores is spread out along the continuum, though there is some tendency toward skewness with the scores clustering near the high scores and tapering off toward the low scores. However, no Social Studies major achieved a perfect score of 51. This is quite different from the Natural Science distribution where there is no apparent skewness, and the whole distribution is slipped below the other four distributions.

Thus, even though there is no difference among the four Secondary majors as to central location, the total distribution presents some distinctive characteristics as to clustering and range of scores.

The Elementary majors, on the other hand, and perhaps due to the large number of them, present a nearly symmetric distribution which is almost bell-shaped.

Summarizing the results of the Social Studies Reading test, it was found that all the four Secondary major groups achieved a higher mean score than that achieved by the Elementary majors. The four Secondary majors did differ in characteristics of the total distribution of scores. They differed among themselves and also differed from the Elementary distribution.

Word Usage Achievement. Table 6.28 includes the means and variances of the five distributions of scores on the Word Usage Achievement test taken during the senior year. This test presents a different picture from that found previously, for in none of the other tests was there such marked differences among these variances. The ratio of the largest to the smallest variance is somewhat more than four to one (the Mathematics to the English-Language Arts majors). In spite of this, the one-way analysis of variance was used to detect difference among the five means, relying as before, on the robustness of the F test in the face of violation of its assumptions. The results are presented in Table 6.29.

The resulting F value indicates that differences do exist among the five means. In view of the size of this F, one is not included to be too suspicious of it in spite of the sampling fluctuations that are present in several of the groups included. Upon examining the mean differences in an attempt to find out which means are contributing to the significant F value, the S method using the 5% confidence interval for contrasts among means yields the following information:

a) The English-Language Arts majors achieved a significantly higher mean score than the Elementary majors and the Mathematics majors.

b) The Social Studies majors achieved a significantly higher mean score than the Elementary majors and the Mathematics majors.

c) All other pairs of mean scores for these majors did not differ.

d) The combined mean of the English-Language Arts and Social Studies majors was significantly higher than the combined mean of the Natural Sciene majors and the Mathematics majors.

e) The combined means of all Secondary majors was significantly higher than the mean score of the Elementary majors.

f) The combined mean of the English-Language Arts majors and the Social Studies majors was significantly higher than the mean score of the Elementary majors, but the combined mean of the Mathematics and Natural Science majors was not significantly higher than the mean score of the Elementary majors.

Thus, the five majors are separated into two distinct groups. The English-Language Arts and Social Studies majors achieved the highest mean scores while the Elementary and Mathematics majors achieved the lowest mean scores. The mean score of the Natural Science majors falls somewhere between and roughly equidistant from both of these groups on the test of facility in word usage.

Table 6.28 - Means and Variances of the Word Usage Achievement Test Scores of Graduating Seniors in Five Teacher Education Curriculums

	Elem	Eng-LA	Math	Nat Sci	Soc St
N	309	65	42	29	45
Mean	66.97	75.60	67.67	70.66	73.13
Variance	61.6258	25.6500	112.4715	77.0711	38.2546

Table 6.29 - Analysis of Variance of the Word Usage Achievement Test Scores of Graduating Seniors in Five Teacher Education Curriculums

S.V.	df	SS	MS	F
Between Curriculums	4	5025.7607	1256.4402	20.958**
Within Curriculms	485	29075.4230	59.9593	
Total	489	34101.1837		

**Significant beyond the .001 level.

Table 6.30 - Distribution of the Word Usage Achievement Test Scores of Graduating Seniors in Five Teacher Education Curriculums

Test	Elementary		Eng-LA		Mathematics		Nat Sci		Soc St	
Scores	freq	cum %	freq	cum %	freq	cum %	freq	cum %	freq	cum %
84-86			1	100.00					1	100.00
81-83	5	100.00	7	98.36	1	100.00	2	100.99	2	97.56
78-80	9	98.25	16	86.89	9	97.56	5	92.31	8	92.68
75-77	35	95.10	18	60.66	3	75.61	3	73.08	9	73.17
72-74	42	82.87	10	31.15	4	68.29	2	61.54	8	51.22
69-71	42	68.18	3	14.75	3	58.54	5	53.85	5	31.71
66-68	38	53.50	2	9.84	3	51.22	2	36.62	4	19.51
63-65	45	40.21	2	6.56	6	43.90	1	26.92	2	9.76
60-62	25	24.48	2	3.28	4	29.27	2	23.08	2	4.88
57-59	15	15.73			2	19.51	1	15.38		
54-56	18	10.49			3	14.62	1	11.54		
51-53	5	4.20			0	7.32	1	7.69		
48-50	3	2.45			1	7.32	1	3.85		
45-47	3	1.40			0	4.88				
42-44	1	.35			0	4.88				
39-41					2	4.88				
N		286		61		41		26		41
$\overline{X}$		66.786		75.655		67.365		69.884		73.585
sd		7.5797		4.9804		10.6374		8.9796		5.6041

Considering these results along with those from the English Usage test, one could observe that there are no differences between these majors in how they use words, but there may be differences in the kinds of words that they use. The English-Language Arts and Social Studies majors perhapts have a different kind of vocabulary than that possessed by Elementary, Natural Science, and Mathematics majors. The latter groups are limited by the nature of their fields of concentration to a single and concise vocabular or to a technical jargon, and the words that appear on this test are not of this nature.

The cumulative percentage distribution and the grouped frequency distribution for the Word Usage test are presented in Table 6.30. The widest descrepancy between the Social Studies and English-Language Arts majors and the other three curriculum groups occur in the lower ranges of the score continuum. Here the 10th percentile of the English-Language Arts and Social Studies majors corresponds to about the 40th percentile for the Natural Science majors, the 54th percentile for the Mathematics majors, and the 58th percentile for the Elementary majors. Thus, nearly 90% of the Social Studies and English-Language Arts majors score better than nearly half of the other three majors.

The 50th percentile of the English-Language Arts and Social Studies majors corresponds to the 90th percentile for the Elementary majors, but the people who score in the upper ranges of the Mathematics and Natural Science distributions do as well as those who score in the upper ranges of the Social Studies distribution. Only the English-Language Arts majors maintain their superiority throughout the distributions. Furthermore, until about the 45th percentile point, the Elementary group performs better on this test than the Mathematics group, a situation which did not hold in any of the other tests in this analysis. From the frequency distribution in Table 6.30, there are three very low scores in the Mathematics group and two of these people were below the lowest Elementary score. In most of the other tests, it was the Elementary group that had the lowest scores.

The frequency distributions for the English-Language Arts majors and the Social Studies majors show considerably less variability and much more clustering near the upper end of the distribution than the other three major groups. While neither of these distributions contain a perfect score of 88, there is an indication that the test was easy for these people; and a ceiling effect may be operating here though it is not as pronounced as in other tests in this battery. This test would not be effective in discriminating between English-Language Arts majors for nearly 85% of these people fall in the first five intervals. Also, it would not be successful in discriminating among Social Studies majors, for nearly 68% of these people fall in the upper five frequency intervals. The scores for the other three majors are distributed throughout the score continuum and the test would probably successfully and reliably separate the Elementary, Mathematics, and Natural Science majors with respect to word usage.

In short, the Word Usage Achievement test scores indicate that while the English-Language Arts and Social Studies majors do not differ in their performance on this test, they do achieve a higher mean score, show much less variability, and cluster more near the upper end of the score distribution than Mathematics, Elementary, and Natural Science majors. This test would not be useful in discriminating within the English-Language Arts and Social Studies curriculum, though it would perhaps successfully discriminate among Mathematics, Natural Science, and Elementary majors in terms of word usage achievement.

Chapter VII

The Comparisons of the Achievement of Persists and Nonpersists in Five Curriculums

Introduction

The previous chapter presented a comparison of the five major groups, Elementary, English-Language Arts, Mathematics, Natural Science, and Social Studies, on each of the five areas of achievement covered in the test battery. From those data, differences among the five majors were found, but were a function of which area of achievement was under consideration. In this chapter each of the major groups is split into two groups, persists and nonpersists, according to the criterion established in Part I of the study. That is, students were classified as persists if they had graudated from the College of Education or if they were currently enrolled in the College of Education. Those who did not fall into either of the above situations were classified as nonpersists.

The questions which this chapter attempts to answer are two.

Are there differences in the level of educational development, at the beginning of the junior year, among those who persisted to graduation and those who did not?

Are there differences in the level of educational development at the beginning of the junior year among those who persisted to graduation and those who did not, after adjustment has been made for the level of scholastic ability of the students?

The first of these questions will be answered by subjecting the data to a test of statistical significance of mean difference between persists and nonpersists using a two sample t test. However, it must be noted that in many cases the sample size is small and the variability with the sample is large, resulting in considerable overlap of the distributions of scores for the two groups. In such cases, a demonstrated statistical significance of a mean difference loses its practical usefulness in terms of subsequent interpretations related to decision-making processes. Accordingly, the grouped frequency distributions of the scores obtained from these samples are presented for consideration along with the test of significance and will be discussed in conjunction with the results of the statistical test.

The second question will be considered by a reanalysis of the scores obtained by the persists and nonpersists within each major group, using analyses of covariance. The covariate to be used in this analysis is the score on the Miller Analogy Test taken by these people at their entrance to the junior year.

The covariate in this case serves two functions: 1) To reduce the error variance and therefore increase the precision of the statistical test of the differences between the means of the two groups; 2) to adjust the mean on the various achievement tests for differences in the covariate. The latter is a statistical control of otherwise uncontrolled differences between the groups with respect to the covariate which is used in the absence of perhaps more desirable experimental control of these differences.

When covariance is used as a method of error control, it is because observed variation in the dependent variable is, in part, due to variation in the covariate. This implies that variation between the means of the dependent variable is affected by variation in the means of the covariate and, for comparison purposes, dependent means should be adjusted to make them better estimates of what they would have been if the covariate means had been the same. When covariance is used to adjust means of the independent variable, it is done because a regression situation is present which calls for an adjustment of error. That is, if the correlation between the dependent variable and the covariate is greater than zero, variation in the covariate is contributing to variation in the dependent variable; and a difference between means on the covariate for the two groups can contribute to a difference between means on the dependent variable for the two groups. Thus the means of the dependent variable are likely to be different, not because of treatment difference but because of differences on the covariate. If the means of the dependent variable could be observed at some common value for the covariate, then differences between them would not be marked.

The techniques of covariance mades this adjustment on the y values according to the model, (in the problem involving two groups and one covariate) $Y = \mu + \beta(X-\bar{X}) + \varepsilon$, or equivalently, $Y - \beta(X-\bar{X}) = \mu + \varepsilon$, for each group.

In the two group case, the adjusted dependent variable, Y, provides a way to compare the groups with the linear effect of the covariate removed, and furthermore, the analysis of covariance for two groups is equivalent to a two sample t test on the adjustment Y values to determine whether or not the means of the adjusted Y values are significantly different.

Thus, the questions considered in this chapter are two ways of looking at the same data. Both are t tests, one using unadjusted scores and the second using adjusted scores. The second is an attempt to increase the precision of the first analysis by equating the groups on a measure of scholastic ability and as such can be compared with the first analysis.

The use of covariance assumes that:

1) The treatments administered will not affect the covariate.

2) The regression of the dependent variable on the covariate is linear with equal regression coefficients in the two groups which are not zero.

3) The adjusted dependent variables are normally and independently distributed with a common variance.

The first is assumed to be satisified since the covariate measure was taken at the time of entrance to the College and before the "treatments" (enrollment in the College) was realized. The second was tested as part of the analysis and the third involves the usual assumptions for the t test and F tests. These were not tested relying, as in the previous chapter, on the robustness of these statistics in the face of violation of these assumptions.

Elementary Education

Persists and Nonpersists Compared

Table 7.1 presents the mean variances sample sizes and t values for the two criterion groups in the Elementary IA curriculum on each of the five achievement tests.

In this table, the means differ at most by only three points. The variances and the standard deviations are remarkably similar. The t test of the significance of the difference between the means, indicates that only on the Word Usage Achievement test did the differences fail to reach the 5% level of significance (t = 1.01). The other distributions exhibit a significant difference between the mean score obtained by the persists when compared to the mean score of the nonpersists. The difference is consistently in favor of the persists.

However, when such results are to be used in decision-making processes pertaining to the problem of distinguishing persists from nonpersists for admission and/or retention in teacher training institutions, it is of interest to consider not only means differences but also the extent of overlap between the two distributions or, lacking that, a minimum amount of overlap if these tests are to be at all efficient in distinquishing persists from nonpersists.

Accordingly, Tables 7.2 - 7.6 present the grouped frequency distributions of scores obtained by the two criterion groups for the Elementary majors. In every one of these tables the amount of overlap of one distribution with the other is almost complete. Though the mean scores obtained by the two groups differ on four of the five tests, nearly half of the nonpersists do as well as an equal fraction of the persists. In other words, none of these tests seems to effectively separate persists from nonpersists in the Elementary majors included in this group.

Thus the answer to the first question with respect to the Elementary majors i.e., "Do persists and nonpersists differ on their level of ecucational development?" is yes when the t statistics are used to detect such differences. However, caution should be exercised in the use of these statistical results in vew of the nearly 100% overlap in the score distributions of the two criterion groups.

Adjustments for Scholastic Ability

The second question as to whether or not there will exist differences between persists and nonpersists after adjusting the scores for level of scholastic ability is answered by the analysis of covariance presented in Tables 7.7 - 7.11. For the two group case, the analyses of covariance amounts to a two sample t test on the adjusted scores so that the results of the following covariances can be compared with the t test on the unadjusted scores presented in Table 7.1 above.

The t test of the mean difference on the English Usage Achievement Test was 2.74 (470 df) which falls beyond the .01 level of significance. The F value for these same scores adjusted for level of scholastic ability is 3.83

Table 7.1

Means and Variances of the Distributions of Scores on Five Achievement Tests for Persists and Nonpersists in Elementary Education Juniors

Elem. Juniors	English Usage	Mathematics Usage	Soc.Studies Reading	Nat.Sci. Reading	Word Usage
Persists (N = 389)					
Mean	48.699	15.018	31.368	27.429	64.273
Variance	85.1284	23.9868	44.558	39.137	80.823
Nonpersists (N = 83)					
Mean	45.554	13.470	29.542	24.723	63.084
Variance	90.9818	29.3253	57.056	48.837	98.444
	t = 2.74** (470 df)	t = 2.40*	t = 2.04*	t = 3.26**	t = 1.01

* Significant at .05 level

** Significant at .01 level

Table 7.2

Frequency Distributions of Scores on the English Usage Achievement Test for Persists and Nonpersists in the Elementary Curriculum

Test Scores	Persists freq	Persists cum %	Nonpersists freq	Nonpersists cum %
67-69	4	100.00		
64-66	8	98.97	4	100.00
61-63	29	96.92	3	95.18
58-60	26	89.46	3	91.57
55-57	38	82.78	9	87.95
52-54	52	73.01	3	77.11
49-51	58	59.64	6	73.49
46-48	40	44.73	8	66.27
43-45	41	34.45	16	56.63
40-42	34	23.91	5	37.35
37-39	16	15.17	11	31.33
34-36	24	11.05	8	18.07
31-33	6	4.88	4	8.43
28-30	6	3.34	1	3.61
25-27	4	1.80	1	2.41
22-24	0	.77	1	1.20
19-21	1	.77		
16-18	1	.51		
13-15	0	.26		
10-12	1	.26		
N	389		83	
$\bar{X}$	48.7197		45.5542	
sd	9.225		9.534	

Table 7.3

Frequency Distributions of Scores on the Mathematics Usage Achievement Test for Persists and Nonpersists in the Elementary Curriculum

Test Scores	Persists freq	Persists cum %	Nonpersists freq	Nonpersists cum %
29-30	1	100.00		
27-28	6	99.74		
25-26	11	98.20	5	100.00
23-24	14	95.37	1	93.98
21-22	21	91.77	3	92.77
19-20	31	86.38	4	89.16
17-18	50	78.41	7	84.34
15-16	57	65.55	12	75.90
13-14	73	50.90	15	61.45
11-12	68	32.13	11	43.37
9-10	26	14.65	10	30.12
7-8	18	7.97	7	18.07
5-6	8	3.34	5	9.64
3-4	5	1.29	3	3.61
N	389		83	
$\bar{X}$	14.9858		13.4518	
sd	4.894		5.412	

Table 7.4

Frequency Distributions of Scores on the Social Studies Reading Achievement Test for Persists and Nonpersists in the Elementary Curriculum

Test Scores	Persists freq	Persists cum %	Nonpersists freq	Nonpersists cum %
45-46	1	100.00	1	100.00
43-44	15	99.74	1	98.80
41-42	20	95.89	4	97.59
39-40	29	90.75	1	92.77
37-38	26	83.29	5	91.57
35-36	40	76.61	11	85.54
33-34	39	66.32	7	72.29
31-32	45	56.30	13	63.89
29-30	51	44.73	7	48.19
27-28	31	31.62	10	39.76
25-26	32	23.65	4	27.71
23-24	21	15.42	4	22.89
21-22	17	10.03	2	18.07
19-20	9	5.66	3	15.66
17-18	7	3.34	1	12.05
15-16	3	1.54	6	10.84
13-14	2	.77	3	3.61
11-12	1	.26		
N	389		83	
$\overline{X}$	31.3817		29.4759	
sd	6.671		7.556	

Table 7-5

Frequency Distributions of Scores on the Natural Science Reading Achievement Test for Persists and Nonpersists in the Elementary Curriculum

Test Scores	Persists freq	Persists cum %	Nonpersists freq	Nonpersists cum %
43-44	1	100.00		
41-42	10	99.74	1	100.00
39-40	4	97.17	1	98.80
37-38	14	96.14	2	97.59
35-36	21	92.45	3	95.18
33-34	30	87.15	5	91.57
31-32	39	79.43	4	85.54
29-30	49	69.41	7	80.72
27-28	50	56.81	12	72.29
25-26	50	43.96	8	57.83
23-24	37	31.11	12	48.17
21-22	37	21.59	4	33.73
19-20	19	12.08	8	28.92
17-18	11	7.20	5	19.28
15-16	8	4.37	4	13.25
13-14	5	2.31	3	8.43
11-12	2	1.03	3	4.82
9-10	1	.51	1	1.20
7-8	1	.26		
N	389		83	
$\bar{X}$	27.4434		24.7530	
sd	6.254		6.989	

Table 7.6

Frequency Distributions of Scores on the Word Usage Achievement Test for Persists and Nonpersists in the Elementary Curriculum

Test Scores	Persists		Nonpersists	
	freq	cum %	freq	cum %
84-86			1	100.00
81-83	4	100.00	0	98.80
78-80	16	98.97	2	98.80
75-77	28	94.86	4	96.39
72-74	43	87.66	13	91.57
69-71	46	76.61	7	75.90
66-68	48	64.78	9	67.47
63-65	55	52.44	9	56.63
60-62	35	38.30	12	45.78
57-59	38	29.31	6	31.33
54-56	27	19.54	5	24.10
51-53	20	12.60	4	18.07
48-50	10	7.46	4	13.25
45-47	9	4.88	1	8.43
42-44	7	2.57	6	7.23
39-41	2	.71		
36-38	0	.26		
33-35	1	.26		
N	389		83	
$\overline{X}$	64.2622		62.9879	
sd	8.99		9.922	

for these adjusted scores, which approaches a significance level of .05 and will, arbitrarily, be assumed to indicate a sufficiently large difference on adjusted means so as to be indicative of the fact that Elementary persists do obtain a higher score on the average on the English Usage test than do Elementary nonpersists.

Table 7.7 - Analysis of Covariance for Persists and Nonpersists in the Elementary Curriculum on an English Usage Achievement Test Adjusted for MAT Scores*

S.V	d.f	S.S.(adj)	MS(adj)	F
Between Groups	1.00	268.74848	268.74848	3.83
Within Groups	462.00	32384.49829	70.09632	
Total	463.00	32653.24677	[Note: $F_{.95}$ (1.462 = 3.86)]	

*Students who did not have MAT scores were omitted from the original sample.

The adjusted means on English Usage test for persists and nonpersists are respectively,

$$48.46 = 48.66 - .439\ (61.33 - 60.88)$$

and

$$46.47 = 45.55 - .439\ (58.81 - 60.88)$$

where the variance of the adjusted mean difference is 1.04, yielding a t value of approximately 1.96 = $\sqrt{3.83}$ which, with 462 df, is significant.

Thus the analysis of covariance for these two groups suggests a significant mean difference. This tends to be true whether or not the scores are adjusted for level of scholastic ability in the two groups. Here, again, one may wish to temper the interpretation of such point differences in view of the unusual amount of overlap of the two distributions.

The t test for the difference between unadjusted mean scores on the Mathematics Achievement Test was 2.40 significant beyond the .05 level. The analysis of covariance or, equivalently, the t test for adjusted mean scores on the same test for Elementary persists and nonpersists is presented in Table 7.8. The F value is 3.36 which is below the 5% level and is not significant.

Table 7.8 - Analysis of Covariance for Persists and Nonpersists in the Elementary Curriculum on a Mathematics Usage Achievement Test Adjusted for MAT Scores

S.V.	d.f	SS(adj)	MS(adj)	F
Between Groups	1.00	73.42733	73.42733	3.38
Within Groups	462.00	10108.67605	21.88025	
Total	463.00	10182.10338		

The adjusted means on this test for persists and nonpersists, respectively, are

$$14.91 = 14.99 - .191 \quad (61.33 - 60.88)$$

and

$$13.87 = 13.47 - .191 \quad (58.81 - 60.88)$$

where the variance of the mean difference is .3243 yielding a t value of difference of $1.83 = \sqrt{3.36}$. The t test of the adjusted means fails to reach significance, however, referring back to the unadjusted t value of 2.40. The result of the adjustment has been to wipe out the unadjusted significant difference. At least part of this latter value was, in all probability, due to differences in the group in level of scholastic aptitude rather than differential achievement in the area of Mathematics Usage as measured by this achievement test.

There is no significant differences between persists and nonpersists among the Elementary majors as indicated by the covariance technique. Furthermore, the disappearances of point differences in the face of adjusting for scholastic ability is more in line with the amount of overlap exhibited in Table 7.3 with respect to the frequency distributions of the scores obtained by the two criterion groups. The Mathematics Achievement test does not distinguish persists from nonpersists. Each group does equally as well (or poorly) when ability level is controlled. The analysis of covariance for the Social Studies Reading Achievement test is presented in Table 7.9. The F value of 2.12 is not large enough to reach the accepted level of significance and the conclusion that adjusted mean scores of Elementary persists and nonpersists on this test are not significantly different seems justified.

Table 7.9 - Analysis of Covariance for Persists and Nonpersists in the Elementary Curriculum on a Social StudiesReading Achievement Test Adjusted for MAT Scores

S.V	d.f	SS(adj)	MS(adj)	F
Between Groups	1.00	84.49577	84.49577	2.12
Within Groups	462.00	18427.42039	39.88619	
Total	463.00	18511.91616		

The adjusted means for persists and nonpersists on this test are, respectively,

$$31.20 = 31.31 - .257\ (61.33 - 60.88)$$

and $$30.08 = 29.54 - .257\ (58.81 - 60.88)$$

where the variance of the mean difference is .5912. This yields a t value of $1.46 = \sqrt{2.12}$ which is not significant.

The t test on the unadjusted scores on the Social Studies Test was significant at the 5% level, but the adjustment has erased the difference. The Social Studies Reading Achievement test does not distinguish between Elementary persists and nonpersists and this is supported by the overlap in the score distributions.

Table 7.10 presents the analysis of covariance for persists and nonpersists among Elementary majors on the Natural Science Reading Achievement test. The F value of 7.54 is beyond the .01 level of significance and indicates the adjusted mean scores for the two criterion groups are statistically different. The adjusted mean for persists and nonpersists are, respectively,

$$27.23 = 27.35 - .265\ (61.33 - 60.88)$$

and $$25.27 = 24.72 - .265\ (58.81 - 60.88)$$

where the variance of the adjusted mean difference is approximately equal to .5064. This yields a t value of $2.75 = \sqrt{7.54}$, the square root of the F statistic. This value is significant beyond the .01 level just as the value of the t statistic for the unadjusted means, 3.26 was significant beyond the .01 level.

Table 7.10 - Analysis of Covariance for Persists and Nonpersists in the Elementary Curriculum on a Natural Science Reading Achievement Test Adjusted for MAT Scores

S.V.	d.f	SS(adj)	MS(adj)	F
Between Groups	1.00	257.58585	257.58585	7.54**
Within Groups	462.00	15784.48602	34.16555	
Total	463.00	16042.07187		

**Significant beyond the .01 level.

The difference has been somewhat attenuated by the adjustment for scholastic ability in the two groups, but the difference was large enough to maintain statistical significance in spite of the subtraction due to adjustment for a covariate. The results of the covariance analysis give considerably more support for the existence of a real difference between these mean scores. However, examination of Table 7.5 indicates nearly 100% overlap in the two distributions; though in this one case, the means are found to be separated by nearly 2 intervals. The variances of the two distributions differ by nearly ten points and the standard deviations by only about 1 point. Thus the Natural Science Reading Achievement Test distinguishes between Elementary persists and nonpersists but only "on the average" and relying on these results to make decisions as to whether a given person would persist or not would leave room for considerable error in prediction.

The analysis of covariance on adjusted mean scores for the Work Usage Achievement Test taken by Elementary majors is presented in Table 7.11. The F statistic yields a value of .04 nonsignificant by most criteria. The adjusted means for the two criterion groups, persists and nonpersists, are respectively 63.95 and 64.13 with the variances of the adjusted mean difference about .91169. One notes that in the adjustment process the magnitude of the means associated with the two criterion groups has reversed itself. The nonpersists adjusted mean in now larger and about equal to the unadjusted mean of the persists with the reverse occurring with the persists. This would not be unexpected if the original bivariate score distributions of Word Usage and MAT scores were almost identical as to location and to variability. Errors in measurement could account for a reversal of two means which were practically identical before the projection via covariance occurred.

Table 7.11 - Analysis of Covariance for Persists and Nonpersists in the Elementary Curriculum on a Word Usage Achievement Test Adjusted for MAT Scores

S.V.	d.f	SS(adj)	MS(adj)	F
Between Groups	1.00	2.31274	2.31274	.04
Within Groups	462.00	28416.32738	61.50720	
Total	463.00	28418.64012		

This may very well have occurred since the unadjusted means showed no statistical difference and furthermore the t value for the adjusted mean scores is about $.196 = \sqrt{.04}$, again nonsignificant. One may conclude that the Word Usage Achievement test does not distinguish persists from nonpersists whether or not scholastic level is controlled and this is again supported by the overlap in the frequency distributions.

To summarize the results on the five achievement tests for persists and nonpersists in the Elementary Curriculum: the initial t test of unadjusted mean differences yielded significant values on four of the five tests. The Word Usage Achievement test was the only test on which a signifcant mean difference was not reported. Examination of the frequency distributions of the scores obtained by the Elementary majors revealed 100% overlap in every case. Under an analysis of covariance where the adjustment introduced a statistical control on level of scholastic ability only one of the intially detected significant mean differences remained. The mean difference on the Natural Science Reading Achievement test remained significant whether or not level of scholastic ability was controlled. For the Elementary Curriculum then, only the Natural Science Reading test could be used to distinguish persists from nonpersists and then such distinctions could only be made with respect to groups "on the average" with considerable risk in prediction because of the large amounts of overlap between the two criterion groups on all these tests.

English-Language Arts Majors

Persists and Nonpersists Compared

The means and variances of the distribution of scores on the five achievement tests obtained by persists and nonpersists in the English-Language Arts Curriculum are listed in Table 7.12. A test for significant differences between the five pairs of means by the t statistic is included in this Table. Only one of the mean differences, the one for the Work Usage Achievement Test, is reliably different beyond the .01 level of significance. The other four statistics do not indicate any significant difference between persists and nonpersists for the English-Language Arts majors on the achievement tests. Three of these, the Mathematics Usage, the Social Studies Reading, and the Natural Science Reading, yield mean scores close enough to make statisitical tests unnecessary. The English Usage and the Word Usage mean scores do yield testable differences one of which is reliable. The t value on the Work Usage test is -2.21, significant beyond the .01 level. More interesting than the existence of these two differences is the direction of these differences. In each of these cases, contrary to expectations, the nonpersists achieve a higher mean score than the persists. Furthermore, the tests on which the significant reversal occurrs is in the areas which all English-Language Arts majors would be expected to excell, and all other things being equal, in an area where one would wish English-Language Arts persists to excell. The sample size is small, but the variance of the nonpersist distribution is very small with standard deviation of approximately 3.97. The small sample size is not

Table 7.12 - Means and Variances of the Distribution of Scores on Five Achievement Tests for Persists and Nonpersists in English-Language Arts

	English Usage	Mathematics Usage	Soc.Studies Reading	Nat.Sci. Reading	Word Usage
Persists					
Mean	55.863	17.288	37.063	30.950	73.063
Variance	46.120	34.435	31.158	38.175	36.540
Nonpersists					
Mean	57.778	17.167	36.500	30.889	75.611
Variance	38.418	50.618	36.265	58.222	15.781
	t = -1.16 (96 df)	t = 0.07	t = 0.49	t = 0.03	5 = -2.21**

**Significant at .01 level

reflected in an exaggerated variance within the nonpersists group and the magnitude of the mean cannot be attributed to extremely high scores. It seems that the nonpersists form a small group all of whom score alike on a Word Usage test and who come from the upper ranges of the score distributions for all English-Language Arts majors. Moreover, this group of nonpersists achieve an unadjusted mean which is higher than the average Word Usage Achievement test score of the persists. Whether or not the mean differences are sufficiently large for identification of persists and nonpersists on the basis of the achievement test battery and doing so with a minimum of classification error can be partially answered by examining the amount of the overlap of the score distributions.

The frequency distributions for the English-Language Arts majors on each of the five achievement test as given in Tables 7.13 - 7.17 shows that in every test case, except the Word Usage test, the overlap is complete and the range of the persists distributions encloses and sometimes equals the range of the nonpersist distributions. Excluding the Word Usage test, the cumulative percentages of the remaining four tests do not show noticeable discrepancies. Those that do show up could be accounted for on the basis of the different sample sizes, 80 persists compared to 18 nonpersists. The existence of equal ranges for both groups implies that the 18 scores are distributed in a more rectangular pattern than the 80 scores in the persist group. Where discrepancies do occur in the ranges of these frequency distributions, for example in the Social Studies Reading test and the Word Usage test, they are due to one extreme score located at the lower end of the persist distribution and not at the bottom of the nonpersist distribution where one might expect to find low scores were, in part, responsible for nonpersistence.

The Word Usage is the only one where nonpersists score higher than persists and this test is also the only one that indicated a significant t value for the difference between the mean scores of the persist and nonpersists. However, the practical usefulness of this difference for use as an identification of persists and nonpersists is obviated by the fact that nearly 40% of the persists reach or exceed the median score of the nonpersists. Thus, identifying a potential nonpersist by a score over 74 on the Word Usage test would probably yield a persist, an error, about 40 times out of 100 and identifying a potential persist by a score over 74 would probably yield a nonpersist about 50 times out of 100. The Word Usage test though showing a significant unadjusted mean difference between persist and nonpersists would not prove to be a useful criterion for discriminating persists from nonpersists.

Adjustments for Scholastic Aptitude

The analysis of covariance was used to detect mean differences that might exist after an adjustment had been made for level of scholastic achievement. As noted previously, the F test for the analysis of covariance between two groups is equivalent to a t test of the significance of the difference between group means after these means have been adjusted for the average Miller Analogies Test score for each group.

The results of the covariance analysis on the English Usage test is given in Table 7.18. The F value of 2.51 is not large enough to indicate a reliable difference between the adjusted means. The adjusted means for

Table 7.13

Frequency Distributions of Scores on the English Usage Achievement Test for Persists and Nonpersists in the English-Language Arts Curriculum

Test Scores	Persists freq	Persists cum %	Nonpersists freq	Nonpersists cum %
67-69	3	100.00	1	100.00
64-66	8	96.25	2	94.44
61-63	8	86.25	2	83.33
58-60	17	76.25	5	72.22
55-57	14	55.00	3	44.44
52-54	8	37.50	3	27.78
49-51	11	27.50	1	11.11
46-48	4	13.75	0	5.56
43-45	4	8.75	0	5.56
40-42	2	3.75	1	5.56
37-39	1	1.25		
N	80		18	
$\overline{X}$	55.8125		57.5000	
sd	6.791		6.198	

Table 7.14

Frequency Distributions of Scores on the Mathematics Usage Achievement Test for Persists and Nonpersists in the English-Language Arts Curriculum

Test Scores	Persists		Nonpersists	
	freq	cum %	freq	cum %
31-32	1	100.00	1	100.00
29-30	3	98.75	0	94.44
27-28	4	95.00	1	94.44
25-26	5	90.00	2	88.89
23-24	2	83.75	1	77.78
21-22	4	81.25	1	72.22
19-20	12	76.25	1	66.67
17-18	8	61.25	2	61.11
15-16	14	51.25	1	50.00
13-14	8	33.75	2	44.44
11-12	11	23.75	1	33.33
9-10	5	10.00	4	27.78
7-8	2	3.75	1	5.56
5-6	1	1.25		
N	80		18	
$\bar{X}$	17.3000		17.1666	
sd	5.868		7.115	

Table 7.15

Frequency Distributions of Scores on the Social Studies Reading Achievement Test for Persists and Nonperisists in the English-Language Arts Curriculum

Test Scores	Persists freq	Persists cum %	Nonpersists freq	Nonpersists cum %
49-50	1	100.00		
47-48	2	98.75	1	100.00
45-46	2	96.25	2	94.44
43-44	8	93.75	1	83.33
41-42	9	83.75	4	77.78
39-40	12	72.50	2	55.56
37-38	12	57.50	3	44.44
35-36	10	42.50	0	27.78
33-34	13	30.00	1	27.78
31-32	2	13.75	2	22.22
29-30	2	11.25	1	11.11
27-28	4	8.75	1	5.56
25-26	2	3.75		
23-24	0	1.25		
21-22	0	1.25		
19-20	0	1.25		
17-18	0	1.25		
15-16	1	1.25		
N	80		18	
$\overline{X}$	37.1250		36.5000	
sd	5.581		6.022	

Table 7.16

Frequency Distributions of Scores on the Natural Science Reading Achievement Test for Persists and Nonpersists in the English-Language Arts Curriculum

Test Scores	Persists freq	Persists cum %	Nonpersists freq	Nonpersists cum %
43-44	1	100.00	1	100.00
41-42	3	98.75	0	94.44
39-40	5	95.00	1	94.44
37-38	9	88.75	1	88.89
35-36	6	77.50	3	83.33
33-34	11	70.00	4	66.67
31-32	8	56.25	2	44.44
29-30	9	46.25	1	33.33
27-28	8	35.00	0	27.78
25-26	6	25.00	1	27.78
23-24	6	17.50	1	22.22
21-22	5	10.00	0	16.67
19-20	2	3.75	1	16.67
17-18	0	1.25	1	11.11
15-16	0	1.25	1	5.56
13-14	1	1.25		
N	80		18	
$\overline{X}$	30.95000		30.8333	
sd	6.178		7.630	

Table 7.17

Frequency Distributions of Scores on the Word Usage Achievement Test for Persists and Nonpersists in the English-Language Arts Curriculum

Test Scores	Persists freq	Persists cum %	Nonpersists freq	Nonpersists cum %
84-86			1	100.00
81-83	8	100.00	2	94.44
78-80	12	90.00	1	83.33
75-77	15	75.00	5	77.78
72-74	21	56.25	7	50.00
69-71	9	30.00	1	11.11
66-68	6	18.75	1	5.56
63-65	4	11.25		
60-62	4	6.25		
57-59	0	1.25		
54-56	0	1.25		
51-53	0	1.25		
48-50	1	1.25		
N	80		18	
$\overline{X}$	73.2250		75.3333	
sd	6.045		3.973	

Table 7.18 - Analysis of Covariance for Persists and Nonpersists in the English-Language Arts Curriculum on an English Usage Achievement Test Adjusted for MAT Scores

S.V.	d.f	SS(adj)	MS(adj)	F
Between Groups	1.00	95.20065	95.20065	2.51
Within Groups	95.00	3607.13252	37.96982	
Total	96.00	3702.33317		

persists and nonpersists, respectively, are 55.74 and 58.30. The variance of the difference of the adjusted means is approximately equal to 2.6067, and the t test for these adjusted means is $-1.59 = \sqrt{2.51}$. In this adjustment the mean of the persists was reduced, the mean of the nonpersists increased, and the magnitude of the mean difference increased over that of the ordinary t test in the first analysis. The increase was not enough to yield statistical significance, though. The suggestion still remains that those who leave the English-Language Arts program may achieve at a higher level, on the average, than those who remain in the program, in the area of English Usage. Nevertheless, the evidence from these data are not sufficient to make any statements about the average English Usage ability of the English-Language Arts nonpersists compared to persists in this major.

The results of the analysis of covariance using the Mathematics, Social Studies, and Natural Science Achievement test data is included in Tables 7.19 - 7.21. In none of these cases did the F test indicate a significant difference between adjusted mean scores. However, the covariance technique did affect these statistics when compared to the unadjusted t tests. In Table 7.12 the means for persists and nonpersists were, respectively, 17.28 and 17.17, the persists being slightly higher than the nonpersists. The adjusted means are 17.16 and 17.94 respectively, with the nonpersists higher than the persists. The adjusted t value is .41. The adjusted t value was .07. In each of these cases, the observed difference in means is unreliable, and likely to change direction as not, in the population of Mathematics Achievement test Scores for English-Language Arts majors. The covariance increased the difference but reversed the direction and leads to the conclusion that English-Language Arts persists and nonpersists exhibited about equal ability (or lack of it) on the Mathematics test.

Table 7.19 - Analysis of Covariance for Persists and Nonpersists in the English-Language Arts Curriculum on a Mathematics Usage Achievement Test Adjusted for MAT Scores

S.V.	d.f	SS(adj)	MS(adj)	F
Between Groups	1.00	4.91175	4.91175	.17
Within Groups	95.00	2755.65537	29.00690	
Total	96.00	2760.56712		

Table 7.20 - Analysis of Covariance for Persists and Nonpersists in the English-Language Arts Curriculum on a Social Studies Reading Achievement Test Adjusted for MAT Scores

S.V.	d.f	SS(adj)	MS(adj)	F
Between Groups	1.00	.00386	.00386	.00
Within Groups	95.00	2060.97362	21.69446	
Total	96.00	2060.97748		

Table 7.21 - Analysis of Covariance for Persists and Nonpersists in the English-Language Arts Curriculum on a Natural Science Reading Achievement Test Adjusted for MAT Scores

S.V.	d.f	SS(adj)	MS(adj)	F
Between Groups	1.00	9.26843	9.26843	.32
Within Groups	95.00	2768.86682	29.14597	
Total	96.00	2778.13525		

The same situation prevails on the Social Studies and Natural Science tests. Whereas the persists achieved an average score higher, though insignificantly so, than the persists on the unadjusted data, the covariance reversed the direction of the inequality and augmented it but not sufficiently for statistical significance.

The adjusted mean scores for persists and nonpersists on the Social Studies Achievement test are respectively, 37.12 and 37.14 with the variance of this mean difference about 1.489 (t = .00).

The adjusted means for the persists and nonpersists for the Natural Science Achievement test are, respectively, 30.79 and 31.59 with the variance of the adjusted mean difference about 2.0009. From Table 7.12 the unadjusted means were 30.95 and 30.89. The differences have been increased and the directions changed. The inconsistency indicated that the persists and nonpersists achieved on the average at about the same level in terms of Natural Science as well as Social Science and Mathematics.

The analysis of covariance for the Word Usage test is presented in Table 7.22. The F value of 6.08 is well beyond the .01 level of significance between English-Language Arts persists and nonpersists, on the Word Usage Achievement test. The adjusted mean for persists is 72.94. The adjusted mean for nonpersists is 76.17 and the variance of this difference is about 1.7165. The t test on these data yields a value of about $2.46 = \sqrt{6.08}$. The unadjusted means for persists and nonpersists were (Table 7.12) 63.06 and 75.61. The covariance has decreased the mean of the persists, increased the mean of the nonpersists and increased the difference between the two.

The difference is significant but again in an unexpected direction. Nonpersists score higher, on the average, than persists. The same difference direction was suggested on the English Usage test.

Table 7.22 - Analysis of Covarance for Persists and Nonpersists in the English-Language Arts Curriculum on a Word Usage Achievement Test Adjusted for MAT Scores

S.V.	d.f.	SS(adj)	MS(adj)	F
Between Groups	1.00	152.01133	152.01133	6.08**
Within Groups	95.00	2375.37305	25.00393	
Total	96.00	2527.38438		

**Significant beyond the .01 level.

In summary, the five achievement tests used in this study do not differentiate between persists and nonpersists in the English-Language Arts Curriculum. In four of the five tests nonpersists achieve on the average at the same level as do persists. In the Word Usage test the nonpersists achieve a higher mean score whether mean is adjusted or unadjusted for scholastic level. However, in all tests there is a complete overlap between the frequency distributions of persists and nonpersists indicating considerable chance for misclassification if the tests were used for identification purposes, in spite of a significant mean difference.

Natural Science Majors

Persists and Nonpersists Compared

Table 7.23 presents the means and variances of the score distributions for five achievement tests for the Natural Science majors. The sample size for this major group is quite small, composed of 38 persists and 14 nonpersists. The effect of the small sample is seen in the variances of these five tests, expecially in the indicated dispersion of the nonpersists on the English Usage test and the dispersion of the persists on the Word Usage test. These variances are very large as is expected in small samples with few observations to fit in the gaps between extreme scores. The means are also affected by extreme scores and tend to fluctuate more so than is desirable for tests of significance. Also, large variances tend to inflate the denominator of the t statistic and result more often than not in accepting the hypothesis of no differences in mean scores.

The sample size should be kept in mind when interpreting the results for this major. Evidence as to whether or not there were detectable differences in the average level of achievement on these achievement tests between persists and nonpersists in the Natural Science Curriculum was gathered by using the two sample t test of the significance of the mean difference. The results of this statistical test are shown in Table 7.23, and indicate that in only one case was the mean scores reliably difference. Only one of the t values, t = -2.08 for the Word Usage test, reaches a probability level small enough to be confident that the difference and the direction of the difference would

Table 7.23 - Means and Variances of the Distributions of Scores on Five Achievement Tests for Persists and Nonpersists in Natural Science

Group	English Usage	Mathematics Usage	Soc.Studies Reading	Nat.Sci. Reading	Word Usage
Persists					
Mean	46.263	24.684	33.711	33.921	67.158
Variance	75.172	70.871	51.238	64.561	137.866
Nonpersists					
Mean	50.929	25.000	35.643	33.071	73.285
Variance	93.764	51.231	37.478	46.071	70.835
	t = -1.58 (50 df)	t = -0.13	t = -0.96	t = 0.38	t = -2.08*

*Significant beyond the .05 level.

be repeated on subsequent investigations with a difference sample of Natural Science majors.

Of the four t tests that showed no significant mean difference, three indicated that the nonpersists scored on the average slightly higher than the persists. The nonsignificant t statistic, however, implies that on repeated sampling and testing this difference is as likely to change direction as not.

The single t statistic that does reach a reasonable level of significance is between the means of the Word Usage Achievement test. Contrary to expectation, this difference is in favor of the nonpersists who achieve a mean score of 73.285 compared to the persists mean score of 67.158. The t value of -2.08 indicates a significant and repeatable difference in subsequent samples from Natural Science majors. However, the variance of the persist group is large (137.866) and undoubtedly had an effect on the t value for this test. The results should be considered with caution pending examination of the frequency distribution.

The frequency distributions are included in Tables 7.24 - 7.28. As in the other major groups included in this chapter, the overlap on these distributions are, with few exceptions, complete. Except on the English Usage Achievement test, the highest score for the persists falls in the same score interval as the highest score of the nonpersists. The one exception shows one nonpersist score one interval higher than any persist score. In most cases, some of the persists scores fall in intervals below the lowest nonpersists scores. This is especially obvious in Table 7.28, the frequency distribution of the Word Usage Achievement test, where about 20% of the

Table 7.24

Frequency Distributions of Scores on the English Usage Achievement Test for Persists and Nonpersists in the Natural Science Curriculum

Test Scores	Persists freq	Persists cum %	Nonpersists freq	Nonpersists cum %
64-66			1	100.00
61-63	2	100.00	1	92.86
58-60	2	94.74	3	85.71
55-57	5	89.47	1	64.29
52-54	3	76.32	1	57.14
49-51	4	68.42	1	50.00
46-48	1	57.89	2	48.86
43-45	4	55.26	0	28.57
40-42	8	44.74	2	28.57
37-39	3	23.68	1	14.29
34-36	4	15.79	1	7.14
31-33	2	5.26		
N	38		14	
$\bar{X}$	46.052		50.857	
sd	8.671		9.683	

Table 2.25

Frequency Distributions of Scores on the Mathematics Usage Achievement Test for Persists and Nonpersists in the Natural Science Curriculum

Test Scores	Persists		Nonpersists	
	freq	cum %	freq	cum %
39-40	1	100.00		
37-38	4	97.37	2	100.00
35-36	0	86.84	0	85.71
33-34	4	86.84	0	85.71
31-32	2	76.32	1	85.71
29-30	3	71.05	2	78.57
27-28	2	63.16	1	64.29
25-26	3	57.89	0	57.14
23-24	2	50.00	1	57.14
21-22	3	44.74	3	50.00
19-20	1	36.84	1	28.57
17-18	6	34.21	2	21.43
15-16	4	18.42	1	7.14
13-14	2	7.89		
11-12	1	2.63		
N	38		14	
$\bar{X}$	24.815		25.071	
sd	8.419		7.157	

Table 2.26

Frequency Distributions of Scores on the Social Studies Reading Achievement Test for Persists and Nonpersists in the Natural Science Curriculum

Test Scores	Persists		Nonpersists	
	freq	cum %	freq	cum %
45-46	2	100.00	1	100.00
43-44	3	94.74	0	92.86
41-42	3	86.84	1	92.86
39-40	4	78.95	3	85.71
37-38	2	68.42	3	64.29
35-36	3	63.16	1	42.86
33-34	4	55.26	1	35.71
31-32	4	44.74	1	28.57
29-30	4	34.21	0	21.43
27-28	1	23.68	1	21.43
25-26	4	21.05	2	14.29
23-24	1	10.53		
21-22	3	7.89		
N	38		14	
$\overline{X}$	33.710		35.500	
sd	7.157		6.122	

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Table 2.27

Frequency Distributions of Scores on the Natural Science Reading Achievement Test for Persists and Nonpersists in the Natural Science Curriculum

Test Scores	Persists freq	Persists cum %	Nonpersists freq	Nonpersists cum %
45-46	2	100.00		
43-44	2	94.74		
41-42	6	89.47		
39-40	4	73.68	4	100.00
37-38	3	63.16	1	71.43
35-36	2	55.26	1	64.29
33-34	3	50.00	4	57.14
31-32	4	42.11	0	28.57
29-30	3	31.58	2	28.57
27-28	2	23.68	0	14.29
25-26	1	18.42	8	14.29
23-24	2	15.79	1	14.29
21-22	2	10.53	0	7.14
19-20	1	5.26	0	7.14
17-18	0	2.63	0	7.14
15-16	0	2.63	1	7.14
13-14	1	2.63		
N	38		14	
$\bar{X}$	33.868		33.071	
sd	8.035		6.788	

Table 7.28

Frequency Distributions of Scores on the Word Usage Achievement Test for Persists and Nonpersists in the Natural Science Curriculum

Test	Persists		Nonpersists	
Scores	freq	cum %	freq	cum %
84-86	1	100.00	1	100.00
81-83	4	97.47	2	92.86
78-80	3	86.84	2	78.57
75-77	3	78.95	3	64.29
72-74	4	71.05	1	42.86
69-71	4	60.53	2	35.71
66-68	5	50.00	1	21.43
63-65	4	36.84	0	14.29
60-62	0	26.32	0	14.29
57-59	3	26.32	2	14.29
54-56	2	18.42		
51-53	2	13.16		
48-50	1	7.89		
45-47	0	5.26		
42-44	0	5.26		
39-41	0	5.26		
36-38	2	5.26		
N	38		14	
$\bar{X}$	67.157		73.642	
sd	11.741		8.416	

persists fall below the lowest interval in the nonpersists distribution. The Word Usage test was the only one which showed a significant mean difference between persists and nonpersists. Two persists scores are considerably below the remaining 36 persists on this word Usage test and their scores tend to pull the mean down from what it would have been had they not been there. However, two nonpersists also score considerably below the rest of the nonpersists and lowers their mean scores, but the nonpersists sample is small. With a larger sample of nonpersists, the gap may have disappeared. The frequency distribution of the persist group is bimodal, the top group positively skewed and the bottom group negatively skewed and almost rectangular. In fact, the top group resembles the total nonpersists group in distribution form and in descriptive statistics. Relatively speaking, persists score both high and low on the Word Usage Achievement test and nonpersists score high. In view of this, it does not seem likely that misclassification would be minimized by using this test for identification purposes. In spite of the significant mean difference in favor of the nonpersists, both nonpersists and persists score high on the test and only about one-third of the persists score low. A few persists score low enough to exaggerate the difference between the two groups and account for statisitical significance of the mean scores, but the practical difference for use in classification decisions seems to be negligible. This is true for all the tests used in this battery.

Adjustments for Scholastic Aptitude

The analysis of covariance, used to detect mean differences between the Natural Science persists and nonpersists is presented following adjustment for scholastic level by means of Miller Analogies Test Scores in Tables 7.29-7.33. Those people who did not have Miller Scores were omitted from this analysis. Table 7.29 includes the analysis of covariances for the adjusted scores on the English Usage Achievement test. The F value of 3.31 is not significant, the value corresponding to the .05 level of significant being 4.045 with 1,47 degrees of freedom. The unadjusted mean for persists and nonpersists were about 46.19 and 50.93. The adjusted means are about 46.13 and 51.10. The variance of this mean difference is about 7.45, the small sample size again being reflected in the large size of this variance. The t value for the adjusted scores is $1.82 = \sqrt{3.31}$ which is not significant at an acceptable probability level. Though the persist mean was decreased and the nonpersists increased, the increase in mean difference was not sufficient to support any degree of confidence that the amount of difference or the direction of the difference would be repeated on subsequent samples or that the observed difference is any different from zero in the population of English Usage test scores for Natural Science majors.

Table 7.29 - Analysis of Covariance for Persists and Nonpersists in the Natural Science Curriculum on an English Usage Achievement Test Adjusted for MAT Scores

S.V.	d.f.	SS(adj)	MS(adj)	F
Between Groups	1.00	248.28241	248.28241	3.31
Within Groups	47.00	3525.36905	75.00785	
Total	48.00	3773.65146		

Tables 7.30, 7.31 and 7.32 present the analysis of covariance for the Mathematics Usage, the Social Studies Reading, and the Natural Science Reading Achievement tests for these Natural Science majors. The F values are too small to reach statistical significance and the differences between the adjusted mean for the persists and nonpersists on these tests are assumed to be equal to zero.

Table 7.30 - Analysis of Covariance for Persists and Nonpersists in the Natural Science Curriculum on a Mathematics Usage Achievement Test Adjusted for MAT Scores

S.V.	d.f.	SS(adj)	MS(adj)	F
Between Groups	1.00	13.08304	13.08304	.27
Within Groups	47.00	2246.00880	47.78742	
Total	48.00	2259.01984		

Table 7.31 - Analysis of Covariance for Persists and Nonpersists in the Natural Science Curriculum on a Social Studies Reading Achievement Test Adjusted for MAT Scores

S.V.	d.f.	SS(adj)	MS(adj)	F
Between Groups	1.00	54.78087	54.78087	1.24
Within Groups	47.00	2084.36102	44.34811	
Total	4800	2139.14189		

Table 7.32 - Analysis of Covariance for Persists and Nonpersists in the Natural Science Curriculum on a Natural Science Reading Achievement Test Adjusted for MAT Scores

S.V.	d.f.	SS(adj)	MS(adj)	F
Between Groups	1.00	.55853	.55853	.01
Within Groups	47.00	2683.61234	57.09813	
Total	48.00	2684.17087		

The adjusted means on the Mathematics Usage test are 24.10 and 25.24 for persists and nonpersists, respectively. The variance of the mean difference is 7.747. The adjusted t value is -.52 compared to an unadjusted t of -.13. The nonpersists still maintain a slight edge over the persists on the Mathematics Usage test. Though the two groups do not differ in their average ability to perform on the test.

The adjusted means on the Social Studies Reading test are 33.41 and 35.74 compared to the unadjusted means of 33.44 and 35.64 for persists and nonpersists respectively. The covariance decreased the persists means and increased the nonpersists mean, increasing the difference between them. The variance of the adjusted mean difference is about 4.405. The adjusted t value is -1.11 compared to a -.96 for the unadjusted means. Again, though the two groups do not differ on the average ability to perform on a Social Studies Achievement test, the nonpersists do slightly better than the persists.

The adjusted means for the persists and nonpersists on the Natural Science Reading Achievement test are 33.41 and 33.17 compared to the unadjusted means of 33.44 and 33.07. Again, the persist mean decreased and the nonpersist mean increased. The variance of the adjusted mean difference is 5.67198 and the adjusted t value is + .38 for the unadjusted mean difference. The persists and nonpersists have become more alike after adjustment for scholastic ability than before adjustment. The means have come closer together, but the persists now have the higher mean whereas the nonpersists were higher before. Again, the non-significance indicates that the direction of the differences will probably reverse on subsequent samples of Natural Science majors and the conclusion of no difference between the groups is accepted.

The Word Usage Achievement test is the only one which yielded a significant t value for the analysis of unadjusted mean differences. The analysis of covariance for this test is presented in Table 7.33. The F value of 5.31 is significant beyond the .05 probability level and indicates a dependable difference between persists and nonpersists remains when the scores are adjusted for the average scholastic ability of the groups of Natural Science majors. The adjusted means are, for persists and nonpersists, respectively, 66.70 and 73.62 compared to unadjusted means of 66.83 and 73.29.

Table 7.33 - Analysis of Covariance for Persists and Nonpersists in the Natural Science Curriculum on a Word Usage Achievement Test Adjusted for MAT Scores

S.V.	d.f.	SS(adj)	MS(adj)	F
Between Groups	1.00	482.21264	482.21264	5.31*
Within Groups	47.00	4271.28103	90.87832	
Total	48.00	4753.49367		

*Significant beyond the .05 level.

The variance of the adjusted mean difference is about 9.0276 and the adjusted t value is -2.31 compared to the unadjusted value of -2.08. The difference between the means has been increased by raising the nonpersists mean and reducing the persists mean by the adjustment using a measure of scholastic ability.

The difference in adjusted means on this test is in favor of the nonpersists, who on the average, perform better on a Word Usage Achievement test than the persists. These results, however, must again be tempered by examination of the frequency distribution. The considerable overlap between score distributions will remain in spite of the scholastic level adjustment.

In summary, analysis of the mean values and score distributions on the five achievement tests for Natural Science majors must be limited because of the small sample size available. However, keeping this limitation in mind, the persists and nonpersists differed in average level of achievement only on the Word Usage test. None of the other four distributions yielded significant mean differences when subjected to an unadjusted t test or when the t test was made on means adjusted for scholastic level. Frequency distributions showed almost complete overlap of the scores for the two groups. Thus, in spite of one demonstrated reliable mean difference, the Natural Science majors who leave the program do not differ from those who persist.

Social Studies Majors

Persists and Nonpersists Compared

Table 7.34 includes the means, sample sizes, and variances of the distributions of scores for persists and nonpersists in the Social Studies Curriculum. This table also includes the results of the t statistic which was used to answer the question of whether or not significant differences exist between those Social Studies majors who persisted to graduation and those who did not with respect to average level of performance on achievement tests at the junior year. If such differences do exist and they are reliable enough to expect to reoccur on subsequent samples of Social Studies majors, then these tests might be used, with other relevant data, for purposes of selective admission to the Social Studies Curriculum.

Table 7.34

Means and Variances of the Distributions of Scores on Five Achievement Tests for Persists and Nonpersists in Social Studies Curriculum

	English Usage	Mathematics Usage	Soc.Studies Reading	Nat.Sci. Reading	Word Usage
Persists					
Mean	49.689	18.541	38.787	30.393	70.049
Variance	66.685	44.386	37.471	56.876	47.014
Nonpersists					
Mean	46.926	17.111	36.444	29.963	67.593
Variance	78.071	30.949	32.872	42.191	56.020
	t = 1.38 (86 df)	t = 1.04	t = 1.73	t = 0.27	t = 1.46

Examination of the t values reported in Table 7.34 shows that not a one of these statistics reaches a probability level small enough to permit much confidence in the reliability of direction difference. All of the t tests indicate acceptance of the hypothesis of no difference between the mean scores of persists and nonpersists. In terms of average levels of achievement, the nonpersists and persists can be assumed to be the same. In spite of the nonsignificance, the differences were all in the expected direction, that is, in favor of the persists. So, though the persists do not score significantly higher than the nonpersists, they do score higher and the t values for Social Studies Reading lies beyond the .10 level of significance. The frequency distributions are reported in Tables 7.35 - 7.39. In most of these distributions the range of scores for persists and nonpersists is about the same, and in all cases, the nonpersists distribution is included entirely within the range of scores of the persists. Where the distributions do differ noticeably, it is because of an extremely low or high score in the persist group, as in the Social Studies Reading Achievement test where one persist scores 15 points below the next lowest score and in the Mathematics test where one persist scores four intervals above the highest nonpersists score. These extreme scores tend to distort the interpretations that can be made from the tests of mean differences since they are indicative of some skewness, a factor which shifts the mean from where it would have been if those extreme scores had not existed. A significance test of the difference between median scores is perhaps more appropriate for skewed distributions, such as the Social Studies Reading test, in spite of the acknowledged loss of power. On the other hand, if the one low persist score on the Social Studies test were omitted, the mean scores would have been even more affected by the large frequency of sixteen near the top of the distribution and what was only approaching significance in the t test of Table 7.34 would have reached an acceptable level of .05; but again due to negative skewness and perhaps not a difference in persist and nonpersist mean scores.

The range and dispersion of scores in both persist and nonpersist distributions is particularly noticeable in the Natural Science Reading Achievement test. There is again evidence of negative skewness which again calls the t statistic into question with its reliance on normality. However, the cluster of scores in the interval 33-34 counteracts the effect of negative skewness, and the nonpersists distribution also exhibits the negative skewness. This test seems to discriminate within the persists group but it does not separate the persists from nonpersist majors, since the overlap of scores is complete.

The Word Usage test which did yield significant mean differences in other majors does not discriminate between persists and nonpersists in this major. The score distributions are nearly identical though the persists distribution is bimodal and the nonpersists unimodal. In any case, the t tests for significant mean differences between persists and nonpersists on all five achievement tests yield no reliable differences. The frequency distributions indicate that the amount of overlap between the two distributions supports the hypothesis of no difference between groups.

Adjustments for Scholastic Aptitude

To answer the question of whether or not differences exist in the level of educational development at the beginning of the junior year among those who persisted to graduation and those who did not, after making an adjustment for average level of scholastic ability in the groups, the

Table 7.35

Frequency Distributions of Scores on the English Usage Achievement Test for Persists and Nonpersists in the Social Studies Curriculum

Test Scores	Persists		Nonpersists	
	freq	cum %	freq	cum %
64-66	1	100.00		
61-63	4	98.36	1	100.00
58-60	4	91.80	2	96.30
55-57	8	85.25	2	88.89
52-54	13	72.13	6	81.48
49-51	5	50.82	2	59.26
46-48	5	42.62	5	51.85
43-45	9	34.43	0	33.33
40-42	5	19.67	3	33.33
37-39	3	11.48	1	22.22
34-36	3	6.56	4	18.52
31-33	0	1.64	0	3.70
28-30	0	1.64	1	3.70
25-27	1	1.64		
N	61		27	
$\bar{X}$	49.459		47.222	
sd	8.166		8.837	

Table 7.36

Frequency Distributions of Scores on the Mathematics Usage Achievement Test for Persists and Nonpersists in the Social Studies Curriculum

Test Scores	Persists		Nonpersists	
	freq	cum %	freq	cum %
37-38	1	100.00		
35-36	0	98.36		
33-34	1	98.36		
31-32	0	96.72		
29-30	1	96.72	1	100.00
27-28	3	95.08	0	96.30
25-26	3	90.16	1	96.30
23-24	9	85.25	3	92.59
21-22	6	70.49	3	81.48
19-20	9	60.66	2	70.37
17-18	5	45.90	4	62.96
15-16	4	37.70	4	48.15
13-14	6	31.15	4	33.33
11-12	6	21.31	1	18.52
9-10	2	11.48	3	14.81
7-8	4	8.20	1	3.70
5-6	1	1.64		
N	61		27	
$\bar{X}$	18.514		17.129	
sd	6.663		5.563	

Table 3.37

Frequency Distributions of Scores on the Social Studies Reading Achievement Test for Persists and Nonpersists in the Social Studies Curriculum

Test Scores	Persists freq	Persists cum %	Nonpersists freq	Nonpersists cum %
47-48	2	100.00		
45-46	5	96.72		
43-44	6	88.52	3	100.00
41-42	16	78.69	4	88.89
39-40	9	52.46	4	74.07
37-38	8	37.70	5	59.26
35-36	4	24.59	2	40.70
33-34	3	18.30	5	33.33
31-32	5	13.11	1	14.81
29-30	0	4.92	0	11.11
27-28	1	4.92	0	11.11
25-26	1	3.28	1	11.11
23-24	0	1.64	1	7.41
21-22	0	1.64	1	3.70
19-20	0	1.64		
17-18	0	1.64		
15-16	0	1.64		
13-14	0	1.64		
11-12	0	1.64		
9-10	1	1.64		
N	61		27	
$\overline{X}$	38.778		36.3963	
sd	6.121		5.735	

Table 7.38

Frequency Distributions of Scores on the Natural Science Reading Achievement Test for Persists and Nonpersists in the Social Studies Curriculum

Test Scores	Persists freq	Persists cum %	Nonpersists freq	Nonpersists cum %
47-48	1	100.00		
45-46	0	98.36		
43-44	0	98.36		
41-42	2	98.36		
39-40	2	95.08	1	100.00
37-38	5	91.80	2	96.30
35-36	8	83.61	6	88.89
33-34	11	70.49	2	66.67
31-32	4	52.46	4	59.26
29-30	6	45.90	4	44.44
27-28	6	36.07	0	29.63
25-26	4	26.23	2	29.63
23-24	7	19.67	1	22.22
21-22	0	8.20	3	18.52
19-20	2	8.20	0	7.41
17-18	0	4.92	0	7.41
15-16	0	4.92	2	7.41
13-14	1	4.92		
11-12	0	3.28		
9-10	0	3.28		
7-8	1	3.28		
5-6	1	1.64		
N	61		27	
$\bar{X}$	30.319		29.944	
sd	7.541		6.495	

Table 7.39

Frequency Distributions of Scores on the Word Usage Achievement Test for Persists and Nonpersists in the Social Studies Curriculum

Test Scores	Persists		Nonpersists	
	freq	cum %	freq	cum %
81-83	1	100.00		
78-80	9	98.36	1	100.00
75-77	7	85.25	0	96.30
72-74	13	73.77	5	96.30
69-71	7	52.46	1	77.78
66-68	11	40.98	10	74.07
63-65	6	22.95	2	37.04
60-62	3	13.11	1	29.63
57-59	4	8.20	1	25.93
54-56	0	1.64	4	22.22
51-53	0	1.64	1	7.41
48-50	1	1.64	1	3.70
N	61		27	
$\overline{X}$	70.000		67.888	
sd	6.856		7.484	

analysis of covariance was used and is reported in Tables 7.40 - 7.44. In every one of these tests, the F value is not significant and indicates no difference between the mean of the persists and the mean of the nonpersists following adjustment for scholastic level.

In four of the five cases the F value is less than one, due to the small sum of squares between groups. In the single case where the F value is greater than one, the Social Studies Reading Achievement test, the probability of an F less than or equal to 3.05 with 1,83 degrees of freedom is about .92 beyond the .10 level of significance and short of the .05 level of significance. The same situation was observed with the unadjusted t value for this test, a t value byond the .10 and less than the .05 level of significance.

The adjusted means for the persists and nonpersists on the Social Studies test are respectively, 38.97 and 36.99 compared to the unadjusted means of 39.22 and 36.44. The variance of the adjusted mean difference is 1.295 and the adjusted t value is $1.76 = \sqrt{3.05}$ compared to the unadjusted t of 1.73. The adjustment has been negligible as far as the statistic is concerned and the mean difference has increased only slightly.

In spite of the increased precision afforded by the covariance technique, this evidence supports the hypothesis that the persists and nonpersists in the Social Studies Curriculum perform equally well on the Social Studies test within the limits of the .05 level of significance.

The adjusted means on the English Usage test are, for persists and nonpersists, respectively, 49.30 and 48.05. The variance of this mean difference is about 3.177 and the adjusted t value is .70 compared to the unadjusted t value of 1.38. The MAT means of the two groups were 65.69 for persists and 61.44 for nonpersists and removal of this source of differential performance has brought the English Usage means closer together with the result that the t value has been reduced from its former value. The adjustment indicates the two criterion groups are alike in their ability to perform on an English Usage test.

Adjusted means for the persists and nonpersists on the Mathematics Usage Achievement test are 18.32 and 17.93 with the variance of the adjusted mean difference about 1.8496. The adjusted t value is .28. The mean difference has been decreased and in turn the test statistical significance, was in part due to differences in scholastic level in the two groups. The mean MAT score for persists was about 65.59 and for the nonpersists was about 61.41. With this difference removed, the two groups perform equally well on the Mathematics Usage test.

The Natural Science Achievement test analysis is the same as for the Social Studies test. The adjustment was negligible and the covariance did not change the results. The adjusted means are 69.56 and 68.67 compared to unadjusted means of 70.07 and 67.59 for persists and nonpersists respectively. The removal of the scholastic level differences between the two groups has changed the t values from an unadjusted to of .27 to an adjusted value of .26. There were no differences before adjustment and no differences are revealed as a result of adjustment. The covariance contributed no new information and the two criterion groups perform equally well on the Natural Science Achievement test.

Table 7.40 - Analysis of Covariance for Persists and Nonpersists in the Social Studies Curriculum on an English Usage Achievement Test Adjusted for MAT Scores

S.V.	d.f.	SS(adj)	MS(adj)	F
Between Groups	1.00	27.76081	27.76081	.49
Within Groups	83.00	4688.14762	56.48371	
Total	84.00	4715.90843		

Table 7.41 - Analysis of Covariance for Persists and Nonpersists in the Social Studies Curriculum on a Mathematics Usage Achievement Test Adjusted for MAT Scores

S.V.	d.f.	SS(adj)	MS(adj)	F
Between Groups	1.00	2.79103	2.79103	.08
Within Groups	83.00	2729.43531	32.88476	
Total	84.00	2732.22634		

Table 7.42 - Analysis of Covariance for Persists and Nonpersists in the Social Studies Curriculum on a Social Studies Reading Achievement Test Adjusted for MAT Scores

S.V.	d.f.	SS(adj)	MS(adj)	F
Between Groups	1.00	70.15478	70.15478	3.05
Within Groups	83.00	1911.18540	23.02633	
Total	84.00	1981.34018		

Table 7.43 - Analysis of Covariance for Persists and Nonpersists in the Social Studies Curriculum on a Natural Science Achievement Test Adjusted for MAT Scores

S.V.	d.f.	SS(adj)	MS(adj)	F
Between Groups	1.00	2.58015	2.58015	.07
Within Groups	83.00	3227.1111	38.888086	
Total	84.00	3229.69125		

Table 7.44 - Analysis of Covariance for Persists and Nonpersists in the Social Studies Curriculum on the Word Usage Achievement Test Adjusted for MAT Scores

S.V.	d.f.	SS(adj)	MS(adj)	F
Between Groups	1.00	14.34715	14.34715	.39
Within Groups	83.00	3032.56176	36.53689	
Total	84.00	3046.90891		

The adjustment for the Word Usage test was effective to the extent of raising the nonpersist mean from 67.59 to an adjusted value 68.67. The persist mean changed from 70.06 to 69.57. The adjusted t value is .63 compared to the unadjusted t of 1.46. The results of the equation of the groups on scholastic ability indicates no difference in the Word Usage performance of the two criterion groups.

Thus the two criterion groups, persists and nonpersists, in the Social Studies Curriculum have been shown, by the statistics used, not to differ on any of the five areas of achievement used in this study. This absence of difference in achievement prevails whether the scores are adjusted for level of scholastic ability or whether they are not adjusted for such ability. However, the adjustment did succeed in removing some slight tendency toward inequality due to scholastic ability observed in the English Usage, the Word Usage, and the Natural Science Reading Achievement test thus making the adjusted mean scores more alike than the unadjusted means on these tests.

Consideration of the frequency distributions in terms of overlap in score ranges and similarity in cumulative percentages further supports the conclusion that these five achievement tests cannot be used for purposes of identification of potential persists in the Social Studies Curriculum. The nonpersists appear to leave the program for reasons other than failure to perform as well as the persists in the areas of achievement studied here.

Mathematics Majors

Persists and Nonpersists Compared

The means and variances sample sizes for the scores on the five achievement tests obtained by the Mathematics majors are presented in Table 7.45. The number of nonpersists in the group is only ten which makes any inferences derived from this data highly tentative. The means and variances with such a small sample tend to fluctuate more than would be desirable and the nonpersist distributions are notably platykurtic, all of which will throw doubt on the reliability of the estimates of the means, variances, and in turn, the t and F tests used in the analysis.

Table 7.45 - Means and Variances of the Distribution of Scores on Five Achievement Tests for Persists and Nonpersists in Mathematics Majors

	English Usage	Mathematics Usage	Soc.Studies Reading	Nat.Sci. Reading	Word Usage
Persists					
Mean	50.265	32.612	35.714	33.571	66.204
Variance	96.741	16.951	49.500	46.833	102.249
Nonpersists					
Mean	47.100	32.200	33.000	32.900	61.800
Variance	68.544	13.956	34.889	29.433	117.511
	t = 1.07 (57 df)	t = 0.31	t = 1.28	t = 0.34	t = 1.18

The t values reported in Table 7.45 and used to answer the question of whether or not significant differences exist in the average level of educational development at the junior year between persists and nonpersists, but not significantly so. This lack of significance may be due either to absence of signficant differences in the population of scores obtained by persists and nonpersists, Mathematics majors, or it may be entirely due to the failure to have a large enough and representative sample of nonpersists on which to base such comparisons of mean differences.

The frequency distributions of the scores obtained by the two criterion groups in the Mathematics Curriculum are given in Tables 7.46 - 7.50. Overlap of distributions is apparent in every one of these distributions, with the nonpersist scores falling completely within the range of the persist score distribution, thus the nonsignificant difference in mean scores is to be expected provided there is an absence of skewness in either distribution. The English Usage test score distribution does exhibit a negative skewness for the persists. The median (52) is higher than the mean (50) whereas on the nonpersist the mean (47) and the median (47.5) differ only by one-half a score unit. Neither the mean or the median are accurate descriptions of such a small sample. However, the test does not seem to discriminate persists from nonpersists on the basis of the frequency distribution.

The overlap, as well as the equal average performance, is also visible on the Mathematics Usage Achievement test as is the low ceiling effect seen in Chapter VI. The persists seem to do no better than nonpersists on this test but both criterion groups excell those from other curriculums on Mathematics achievement.

On the Social Studies test, the overlap is also complete. The nonpersist distribution was completely enclosed by the persist distribution and located near the center of the persist distribution. The persist distribution is slightly negatively skewed but while the means differ by only about 2.5 points, the medicans differ by 6 points (37.1 compared to 31.5) and the shape of the two distributions is quite different, probably accounted for by the small size of the nonpersist sample. The Natural Science Achievement test presents the same picture of score distributions as the Social Studies test. The persist distribution shows a small variance than on the previous test. The means do not differ, but the medians now fall in the same interval on this test, and the nonpersist distribution is again included within the range of the persist distribution. The small sample size again affects the interpretation

The Word Usage Achievement test scores have the largest dispersion for both criterion groups. While the test separates high scoring nonpersists from low scoring nonpersists, it does the same for persists and to the same degree. Persists and nonpersists perform the same on the test. Since the overlap is again complete and the means and medians do not differ statistically, the Word Usage test cannot be used to distinguish persists from nonpersists.

Adjustments for Scholastic Aptitude

To answer the question as to whether or not there are differences in the level of educational development at the junior year between persists

Table 7.46 - Frequency Distributions of Scores on the English Usage Achievement Test for Persists and Nonpersists in the Mathematics Curriculum

Test Scores	Persists		Nonpersists	
	freq	cum %	freq	cum %
64-66	2	100.00		
61-63	4	95.92		
58-60	10	87.76	1	100.00
55-57	3	67.35	2	90.00
52-54	6	61.22	0	70.00
49-51	4	48.98	1	70.00
46-48	5	40.82	3	60.00
43-45	3	30.61	0	30.00
40-42	4	24.49	0	30.00
37-39	3	16.33	1	30.00
34-36	2	10.20	2	20.00
31-33	1	6.12		
28-30	2	4.08		
N	49		10	
$\bar{X}$	50.1836		47.0000	
sd	9.836		8.279	

Table 7.47

Frequency Distributions of Scores on the Mathematics Usage Achievement Test for Persists and Nonpersists in the Mathematics Curriculum

Test	Persists		Nonpersists	
Scores	freq	cum %	freq	cum %
39-40	2	100.00		
37-38	9	95.92	1	100.00
35-36	9	77.55	2	90.00
33-34	5	59.18	3	70.00
31-32	8	48.98	1	40.00
29-30	8	32.65	1	30.00
27-28	5	16.33	1	20.00
25-26	2	6.12	1	10.00
23-24	0	2.04		
21-22	1	2.04		
N	49		10	
$\overline{X}$	32.6836		32.3000	
sd	4.117		3.735	

Table 7.48

Frequency Distributions of Scores on the Social Studies Reading Achievement Test for Persists and Nonpersists in the Mathematics Curriculum

Test	Persists		Nonpersists	
Scores	freq	cum %	freq	cum %
47-48	1	100.00		
45-46	1	97.96		
43-44	5	95.92		
41-42	5	85.71		
39-40	9	75.51	1	100.00
37-38	5	57.14	1	90.00
35-36	7	46.94	1	80.00
33-34	2	32.65	1	70.00
31-32	3	28.57	2	60.00
29-30	2	22.45	0	40.00
27-28	3	18.37	2	40.00
25-26	2	12.24	0	20.00
23-24	2	8.15	1	20.00
21-22	1	4.08	1	10.00
19-20	0	2.04		
17-18	0	2.04		
15-16	0	2.04		
13-14	1	2.04		
N	49		10	
$\bar{X}$	35.6224		32.9000	
sd	7.035		5.907	

Table 7.49

Frequency Distributions of Scores on the Natural Science Reading Achievement Test for Persists and Nonpersists in the Mathematics Curriculum

Test Scores	Persists		Nonpersists	
	freq	cum %	freq	cum %
45-46	1	100.00		
43-44	4	97.96		
41-42	5	89.80	1	100.00
39-40	2	79.59	0	90.00
37-38	5	75.51	1	90.00
35-36	6	65.31	0	80.00
33-34	4	53.06	5	80.00
31-32	6	44.90	2	30.00
29-30	7	32.65	0	10.00
27-28	3	18.37	0	10.00
25-26	2	12.24	0	10.00
23-24	1	8.16	0	10.00
21-22	1	6.12	0	10.00
19-20	1	4.08	1	10.00
17-18	0	2.04		
15-16	1	2.04		
N	49		10	
$\bar{X}$	33.6632		32.9000	
sd	6.843		5.425	

Table 7.50

Frequency Distributions of Scores on the Word Usage Achievement Test for Persists and Nonpersists in the Mathematics Curriculum

Test	Persists		Nonpersists	
Scores	freq	cum %	freq	cum %
81-83	1	100.00		
78-80	5	97.96	1	100.00
75-77	7	87.76	0	90.00
72-74	5	73.47	0	90.00
69-71	3	63.27	1	90.00
66-68	5	57.14	3	80.00
63-65	6	46.94	1	50.00
60-62	4	34.69	1	40.00
57-59	6	26.53	0	30.00
54-56	3	14.29	1	30.00
51-53	2	8.16	0	20.00
48-50	1	4.08	0	20.00
45-47	0	2.04	1	20.00
42-44	0	2.04	1	10.00
39-41	0	2.04		
36-38	0	2.04		
33-35	0	2.04		
30-32	1	2.04		
N	49		10	
$\bar{X}$	66.2040		61.9000	
sd	10.112		10.840	

and nonpersists after adjustment has been made for average scholastic ability of the students, the analysis of covariance was used. The results of these analyses are reported in Tables 7.51 - 7.55. In none of the five achievement areas considered do the F values reach an acceptable significance level. All of them are less than one. Thus, in the process of applying a statistical control for scholastic ability to form a more precise test of the significance of the difference between the average achievement level of the persists and the nonpersists. The mean scores for the two groups have been brought closer together. This result indicates that there is no difference, in average level of performance, between persists and nonpersists in the Mathematics Curriculum in the areas of achievement measured by these five tests.

Table 7.51 - Analysis of Covariance for Persists and Nonpersists in the Mathematics Curriculum on an English Usage Achievement Test Adjusted for MAT Scores

S.V.	d.f.	SS(adj)	MS(adj)	F
Between Groups	1.00	.66143	.66143	.01
Within Groups	56.00	4303.13432	76.84168	
Total	57.00	4303.79575		

The adjusted means on the English Usage test for persists and nonpersists are, respectively, 49.8 and 49.5 with the variance of this adjusted mean difference about 9.915. The adjusted t value then is .1 compared to the unadjusted t of 1.07. The mean MAT score for Mathematics persists is 71.5 and the mean MAT scores for nonpersists is 64.9. Thus the difference in MAT scores between persists and nonpersists is about 7 points. Adjustment for the differences has increased the nonpersists mean and decreased the persist mean, reducing the difference between them. The value of the t statistic accordingly indicates no difference between these two criterion groups on English Usage whether or not the scores are adjusted for scholastic level.

The adjusted means for persists and nonpersists on the Mathematics Achievement test are 32.4 and 33.2 compared to unadjusted means of 32.6 and 32.2. The variance of the adjusted mean is about 1.7564. On this test the adjustment has again increased the nonpersist mean and decreased the persist mean, but in the process has reversed the direction of the difference. Where the persists scored higher than the nonpersists on the unadjusted means, though not significantly so, the adjusted means now show the nonpersists scoring higher than the persists. The adjusted t value is about -.6, still nonsignificant, but in the opposite direction from the unadjusted t value of .31. The nonsignificance of both t values points out the unreliability of the difference, and the fact that no prediction can be made regarding the magnitude or difference in mean values of the two criterion groups in a population of Mathematics majors other than to expect it to be zero. The change of direction here supports the hypothesis of no mean difference in groups, but the inference must be made with caution in view of the small sample size of the nonpersists group.

Table 7.52 - Analysis of Covariance for Persists and Nonpersists in the Mathematics Curriculum on a Mathematics Usage Achievement Test Adjusted for MAT Scores

S.V.	d.f.	SS(adj)	MS(adj)	F
Between Groups	1.00	5.24933	5.24933	.39
Within Groups	56.00	762.28725	13.61227	
Total	57.00	767.53658		

Table 7.53 - Analysis of Covariance for Persists and Nonpersists in the Mathematics Curriculum on a Social Studies Reading Achievement Test Adjusted for MAT Scores

S.V.	d.f.	SS(adj)	MS(adj)	F
Between Groups	1.00	6.80924	6.80924	.16
Within Groups	56.00	2323.83065	41.49698	
Total	57.00	2330.63989		

Table 7.54 - Analysis of Covariance for Persists and Nonpersists in the Mathematics Curriculum on a Natural Science Reading Achievement Test Adjusted for MAT Scores

S.V.	d.f.	SS(adj)	MS(adj)	F
Between Groups	1.00	17.65288	17.65288	.50
Within Groups	56.00	1961.44659	35.02583	
Total	57.00	1979.09947		

Table 7.55 - Analysis of Covariance for Persists and Nonpersists in the Mathematics Curriculum on a Word Usage Achievement Adjusted for MAT Scores

S.V.	d.f.	SS(adj)	MS(adj)	F
Between Groups	1.00	.10286	.10286	.00
Within Groups	56.00	3832.41358	68.43596	
Total	57.00	3832.51644		

The Social Studies Achievement test has an adjusted mean of 35.4 for persists and 34.5 for nonpersists compared to unadjusted means of 35.7 and 33.0, respectively. The persist mean decreased and the nonpersists mean increased with the adjustment for the six point difference in MAT mean scores. The difference in the average level of performance has been reduced by the adjustment but the persists still maintain a slight edge. The variance of the adjusted mean difference is about 5.3544 with the adjusted t value of .4 compared to the unadjusted t value of 1.28. The two criterion groups perform equally well on a Social Studies Achievement test taken at the beginning of the junior year.

The Natural Science Achievement test shows the same reversal seen in the Mathematics Usage test. The adjusted mean on the Natural Science Achievement test for persists is 33.2 and for nonpersists the adjusted mean is 34.7. The unadjusted means for persists and nonpersists respectively on this test were 33.6 and 32.9. The variance of the adjusted means is about 4.519 and the adjusted t value is -.7 compared to the unadjusted t value of .34. The very slight edge that the mean score of the persists showed on the unadjusted mean has been erased and replaced with a higher mean score for the nonpersists after the adjustment for scholastic level was used. However, neither the unadjusted or the adjusted mean difference is signficant and on subsequent samples, one could expect the mean difference to change direction again and be nonsignificant. Again, the small sample size limits the interpretation of the results.

The unadjusted t value on the Word Usage test was reported in Table 7.45 as 1.18. The unadjusted means were 66.2 for persists and 61.8 for nonpersists, a difference of about five points, but the two variances for the test were unusually large compared to those for the other four tests and the differences show up to be nonsignificant. The adjusted means for the criterion groups on this test are 65.5 and 65.4, a difference of one-tenth of a point and the variance of this mean difference is 8.83. The resulting t value for the adjusted means as could readily be ascertained from the adjusted mean values. The small sample does affect these statistics. But, taken at face value, there is no difference between persists and nonpersists in the Mathematics Curriculum in the ability to perform on a Word Usage Achievement test.

The analysis of the average level of educational development for the five achievement areas of the scores obtained by persists and nonpersists in the Mathematics Curriculum reveals no significant differences whether these scores are adjusted for scholastic level or not. The amount of overlap in the score frequency distributions for the two criterion groups further supports the conclusion that persists and nonpersists cannot be differentially identified by their performance on these five achievement tests. However, the size of the sample severely limits the confidence which can be placed in the conclusions from these data.

Chapter VIII

Comparisons of Achievement Levels of Students in Five Teacher Education Curriculums Who Were Tested as Entering Juniors and Graduating Seniors

The previous two chapters analyzed data in order to compare the achievement levels among the five curriculums and between persists and nonpersists. This chapter is concerned with the question of gain in educational development during the junior and senior years.

The Analyses

The general plan for studying achievement was presented in Chapter VI. Entering juniors and graduating seniors were required to take the battery of five achievement tests. The purpose here is to analyze the data for those students who took both tests to find whether there were changes over the six quarters of the junior and senior years. The question of appropriate analysis is considerably simplified in view of the fact that the concern is for the gain for the group rather than for individuals. Analyses of individual gain scores is more difficult and more complicated. Individual gain scores are fragile, but group scores can be analyzed with less concern when tests with acceptable and well-established reliabilities are used.

The presentation of analyses is made in three steps. The first step shows the general relationship of the distributions of junior and senior tests. These test-retest relationships are represented by product-moment correlations. This approach might be interpreted as a study of test-retest reliability except for the long interval of time between administrations. The results do, however, point to the extent to which the two administrations placed individuals in the same order. The second analysis considers changes in mean scores. The procedure to detect differences is the computation of a t statistic which utilizes the correlation between the two tests in the computations rather than assuming that they are independent. The calculations for correlated t tests is a standard procedure found in any statistics text concerned with testing mean differences. The third analysis is also a test of the mean gain but uses the method of analysis of variance and covariance. This analysis uses the MAT score as a covariate and holds constant the relationship of the achievement tests with MAT in considering the significance of the gain scores. The analysis of variance and covariance procedures are described in more detail in the preceding chapter.

The Results

Table 8.1 presents the correlations, (r), between the students' scores as entering juniors and graduating seniors. The twenty-five r's ranged from .41 to .94 with a median of .72. About half of the values ranged between .62 and .80. High r's were found most consistently on the Word Usage Test, indicating that this test was highly consistent in its ranking of students. The correlations were consistently high across all the tests for Elementary, Mathematics, and Natural Science majors. The two lowest r's occur for English-Language Arts and Social Studies majors in those tests most closely related to their major fields, English Usage and Social Studies Reading.

One possible interpretation of Table 8.1 is that what students achieve in the junior and senior years does not generally change the order in which the scores are distributed. Least consistent from entering junior to graduating senior were the achievements of English-Language Arts majors in English Usage and Social Studies majors in Social Studies Reading. Perhaps the last two years of college for these two major fields does more to influence their performance in "their fields" differentially than for others whose performance in the several tests remains more consistent.

Table 8.2 tests the differences between the means of the junior testing with the means of the senior scores for each group. These analyses concern the central tendencies of the two score distributions whereas the analysis presented in Table 8.1 considered the total distributions. The relationship measured by the correlations reported in Table 8.1 was incorporated in test of mean differences through the use of the correlated t test analysis, using the correlation between the two testings in computing variance of the mean differences.

Only five of the twenty-five significance tests failed to reach the 5% level of confidence. There were no changes on the average in the achievement of English-Language Arts majors on the Social Science Reading Test from the entering junior to graduating senior level, though the mean increased significantly in all other tests. Changes for Mathematics majors in Natural Science Reading and Word Usage tests were not large enough to go beyond chance expectations. Natural Science majors gains in the Natural Science Reading test were not significant. Social Studies majors mean scores at the two testings were not significantly different.

Tables 8.3 through 8.7 provide information on the third type of analysis of achievement gain scores. These analyses focused on the gain scores and the average increase (for there were no decreases) from the entering junior level to graduating senior. Since gain scores are influenced by the level of the initial score (for lower beginning scores make increases easier), the analysis provided an adjustment for the initial achievement level. Because achievement usually has a positive relationship with aptitude or ability measures, the analysis also adjusted the gain scores for the level of MAT scores in considering whether the gain was significant. The F value in the five tables represents the results of tests of the significance of the gain scores controlling for junior test scores and for the MAT scores. For comparative purposes, each table also reports the results of the correlated t test analysis reported in Table 8.2.

Table 8.3 reports the results of the analyses for Elementary majors. Only one gain score, on Mathematics Usage, failed to reach significance beyond chance. This particular result is in contrast to the t test result. This more rigorous analysis suggests that the gain in Mathematics Usage scores was not significant considering the level of the junior test and the MAT. For the Mathematics Usage junior score, the starting point was the lowest of the five groups studied, so the 2.11 gain was not significant, whereas a similar gain may have been significant if the initial score had been higher.

Table 8.4 shows that controlling for the two covariates produced different results than the t test on the results of Mathematics Usage and Word Usage tests for English-Language Arts majors. The Natural Science

Table 8.1

Test-Retest Correlations for Students in Five Teacher Education Curriculums Who Took Five Achievement Tests as Entering Juniors and Graduating Seniors

	Achievement Tests				
Curriculum	English Usage	Math. Usage	Soc. St. Reading	Nat. Sci. Reading	Word Usage
Elementary	.68	.68	.71	.62	.89
Eng.-Lang. Arts	.54	.86	.72	.61	.76
Mathematics	.77	.71	.77	.69	.85
Natural Science	.80	.88	.73	.61	.94
Social Studies	.61	.80	.41	.61	.88

Table 8.2

Correlated t Tests of the Differences Among Means for Students Who Were Tested as Entering Juniors and Retested as Graduating Seniors in Five Teacher Education Curriculums on Five Achievement Tests

	Achievement Tests				
Curriculum	English Usage	Math. Usage	Soc. St. Reading	Nat. Sci. Reading	Word Usage
Elementary (291 df)	11.807**	8.951**	5.980**	5.786**	11.314**
Eng.-Lang. Arts (60 df)	3.974**	3.476**	1.247	3.148**	5.352**
Mathematics (40 df)	5.028**	5.699**	3.012**	0.288	1.658
Natural Science (26 df)	3.777**	2.578*	2.187*	1.097	3.013**
Social Studies (41 df)	5.887**	2.002	2.121*	2.101*	6.706**

*Significant beyond .05 level.
**Significant beyond .01 level.

Table 8.3

Means and Variances of Achievement Gain Scores, Junior and Senior Tests Results, and Miller Analogy Scores and the F Tests of the Significance of Gain Scores Controlling for Junior Test and Miller Analogy Test (MAT) Scores for Students in Elementary Education Curriculums

Elementary (N=284)		Achievement Tests				
		English Usage	Math. Usage	Soc. St. Reading	Nat. Sci. Reading	Word Usage
Gain	Mean	4.96	2.11	1.88	1.92	2.74
	Variance	52.044	16.454	27.176	31.611	16.596
Junior Test	Mean	48.70	15.02	31.16	27.29	64.31
	Variance	83.10	23.29	46.34	40.62	79.58
Senior Test	Mean	53.66	17.13	33.04	29.21	67.05
	Variance	75.33	26.87	44.81	41.23	57.44
Miller	Mean	61.34	61.34	61.34	61.34	61.34
	Variance	85.20	85.20	85.20	85.20	85.20
t		11.807**	8.951**	5.980**	5.786**	11.314**
F		43.572***	.662	13.376**	17.46**	103.59***

** ≃ .01 *** ≃ .001

Table 8.4

Means and Variances of Achievement Gain Scores, Junior and Senior Tests Results, and Miller Analogy Scores and the F Tests of the Significance of Gain Scores Controlling for Junior Test and Miller Analogy Test (MAT) Scores for Students in English-Language Arts Curriculum

Eng.-Lang. Arts (N=61)		Achievement Test				
		English Usage	Math. Usage	Soc. St. Reading	Nat. Sci. Reading	Word Usage
Gain	Mean	4.656	1.377	.705	2.246	2.541
	Variance	83.7295	9.5721	19.4781	31.055	13.752
Junior Test	Mean	56.049	17.344	37.377	31.197	73.180
	Variance	44.6809	31.2628	30.505	40.994	31.284
Senior Test	Mean	60.705	18.721	38.082	33.443	75.721
	Variance	73.51	35.67	37.51	38.85	24.80
Miller	Mean	71.328	71.328	71.328	71.328	71.328
	Variance	90.457	90.457	90.457	90.457	90.457
t		3.974**	3.476**	1.247	3.148**	5.352**
F		11.756**	.627	2.028	8.573*	21.762

* ≃ .05 ** ≃ .01

gain score was significant but a lower level of confidence.

The analyses for Mathematics majors, Table 8.5, shows that gain scores from the Social Studies Reading test failed to survive a more rigorous test.

Two differences between the t and F statistics are seen in Table 8.6. The Social Studies gain score for Natural Science majors was not significant when the controlled analysis was used. The reverse was true for the Natural Science Reading test, for considering the level of the junior test and the MAT, the Natural Science Reading test gain was significant for the Natural Science majors.

The analyses for Social Studies majors, Table 8.7, did not produce results which differed from the correlated t test. The levels of confidence did increase for two of the tests however.

In general, it can be said that the five teacher education majors did show significant gains in their levels of educational development over their last two academic years of study. The pattern of gains does differ among the five fields. The English Usage test was the only one on which all groups posted significant gains. Only the Mathematics and Natural Science majors showed gains in Mathematics Usage. The Elementary and Social Studies majors were the only ones of the five to increase their scores on the Social Studies Reading test. The Mathematics majors were the only group that did not gain on the Natural Science Reading test, and the Word Usage test.

Table 8.5

Means and Variances of Achievement Gain Scores, Junior and Senior Tests Results, and Miller Analogy Scores and the F Tests of the Significance of Gain Scores Controlling for Junior Test and Miller Analogy Test (MAT) Scores for Students in the Mathematics Education Curriculum

		Achievement Tests				
Mathematics (N=41)		English Usage	Math. Usage	Soc. St. Reading	Nat. Sci. Reading	Word Usage
Gain	Mean	4.59	2.76	2.10	.220	1.49
	Variance	34.099	9.589	19.890	23.776	33.006
Junior Test	Mean	51.07	32.66	35.81	34.220	65.98
	Variance	84.470	18.1305	41.711	38.176	100.924
Senior Test	Mean	55.66	35.32	37.91	34.44	67.47
	Variance	51.83	14.70	45.74	37.85	113.15
Miller	Mean	71.805	71.805	71.805	71.805	71.805
	Variance	101.1610	101.1610	101.1610	101.1610	101.1610
t		5.028**	5.699**	3.012**	0.288	1.658
F		13.347**	16.968**	1.556	1.390	.221

** ≃ .01

Table 8.6

Means and Variances of Achievement Gain Scores, Junior and Senior Tests Results, and Miller Analogy Scores and the F Tests of the Significance of Gain Scores Controlling for Junior Test and Miller Analogy Test (MAT) Scores for Students in the Natural Science Education Curriculum

		Achievement Tests				
Nat. Science (N=26)		English Usage	Math. Usage	Soc. St. Reading	Nat. Sci. Reading	Word Usage
Gain	Mean	4.423	2.077	2.346	1.423	2.885
	Variance	32.894	15.9138	32.9554	41.294	26.9862
Junior Test	Mean	46.962	25.923	33.192	35.192	67.038
	Variance	94.7585	65.2739	60.8815	61.2815	163.0785
Senior Test	Mean	51.385	28.000	35.538	36.615	69.923
	Variance	57.8462	55.840	48.2585	33.4462	80.6339
Miller	Mean	67.462	67.462	67.462	67.462	67.462
	Variance	129.4585	129.4585	129.4585	129.4585	129.4585
t		3.777**	2.578*	2.187*	1.097	3.013**
F		5.908*	4.509*	.037	6.385*	44.192**

* ≃ .05 ** ≃ .01

Table 8.7

Means and Variances of Achievement Gain Scores, Junior and Senior Tests Results, and Miller Analogy Scores and the F Tests of the Significance of Gain Scores Controlling for Junior Test and Miller Analogy Test (MAT) Scores for Students in the Social Studies Education Curriculum

Social Studies (N=41)		Achievement Tests				
		English Usage	Math. Usage	Soc. St. Reading	Nat. Sci. Reading	Word Usage
Gain	Mean	5.73	1.34	1.59	1.93	3.56
	Variance	41.201	18.381	24.349	35.370	10.902
Junior Test	Mean	50.90	19.00	39.44	31.05	69.95
	Variance	58.79	48.15	22.30	55.85	48.25
Senior Test	Mean	56.63	20.34	41.03	32.98	73.51
	Variance	46.14	46.18	18.17	21.47	31.41
Miller	Mean	66.88	66.88	66.88	66.88	66.88
	Variance	73.71	73.71	73.71	73.71	73.71
t		5.887***	2.002	2.121*	2.101*	6.706***
F		18.22***	.058	12.401***	21.320***	25.452***

***≃ .001 *≃ .05

Chapter IX

Comparisons of MMPI Scores for Men and Women in Five Curriculums

One objective of this study was to extend the study of teacher education majors to consider comparisons based on personality variables. Even though the MTAI, as a measure of attitudes relevant to teacher education, is included in the analyses persented in Chapters III, IV, and V, some further personality data seemed necessary.

The MMPI is part of the required battery of tests for juniors entering the College of Education. The College does not use these test data routinely in considering admissions, but the scores do become an important part of the record when questions of retention are raised because of inadequate or inept teaching performance or problems of human relations which bear on the recommendation for certification. In these situations, the MMPI becomes an important part of the case study data but is never used singly to provide diagnostic generalizations or to serve as the basis for decisions. It is considered one type of evidence which becomes a part of the total pattern of data which are used to determine the decision.

In using the MMPI personnel who had special competence in "reading" the profile provided interpretations. In making their interpretations, counselors used their clinical knowledge of the instrument which would include appropriate consideration of normative studies of college populations. One of the needs which becomes evident in a review of normative data with normal college populations is for more definitive data on teacher education students. The central purpose of the phase of the study reported in this chapter was to provide descriptive, comparative data on the MMPI for teacher education majors.

The Analysis and the Results

The MMPI is a widely used and well-known objective test of personality variables. Since the test, its scoring, and its reporting procedures are well-known, they will not be reviewed here. It is sufficient to say that the tests were given under standardized conditions and scored according to the usual procedures for obtaining K-corrected scores.

The data represent the tests taken by men and women in five teacher education majors. In determining the groups to be used, it seemed desirable to include as many majors as possible and to include both men and women in a field. MMPI data were collected over the three year period of the second part of the longitudinal study, but do not represent data collected over a six year period as is true of the analyses reported in Chapters III, IV, and V. The following list identifies the groups studied and the size of the populations:

Major Field	N	
	Male	Female
Elementary IA	47	464
Mathematics	49	18
Social Studies	83	28
English	30	75
Natural Science	46	9

Though the numbers in some categories are not large, particularly women in Mathematics and Natural Science, the decision was to include them in spite of their size to provide broader comparison possibilities.

A careful study of the score distributions, the scale of summary statistics, and the profiles led to the conclusion that comparative analyses were not warranted. The homogenity of distributions, means, and standard deviations indicated that analysis of variance tests of the differences of means among the five groups of men and women on each of the scales would have been futile. "Eye tests" of the profiles led to the same conclusion.

The value of the data and the analyses was judged to lie, not in any comparative use of the data, but rather in its normative description of the populations studied. It is true, however, that the lack of any differences among major fields is an important finding. The presentation of the analyses is made in a set of eleven tables and eleven figures. Tables 9.1 through 9.11 present the cumulative frequency distributions and the summary statistics for each of the ten clinical scales and the K scale. Figures 9.1 through 9.11 show profiles of the eleven scales for the mean and women in each teacher education major. These tables and figures follow without further analyses or comment.

Table 9.1

Cumulative Percentage Distributions and Summary Statistics for MMPI K Scale Scores for Males and Females in Five Teacher Education Curriculums

K	Elem.		Math.		Soc.St.		Eng.		Nat.Sci.	
Scale	M	F	M	F	M	F	M	F	M	F
29		100								
28	100	99	100							
27	98	99	98					100		
26	98	98	98		100			99	100	
25	96	95	94		98	100	100	97	96	
24	85	92	92	100	94	93	93	95	96	
23	81	88	84	94	92	93	93	93	85	100
22	68	82	71	89	83	93	83	88	76	78
21	60	72	69	83	76	79	83	81	63	78
20	51	62	57	78	66	68	70	73	61	44
19	38	56	51	72	60	57	70	69	54	33
18	32	46	47	67	53	46	57	59	46	33
17	26	38	37	67	42	36	47	43	37	22
16	23	33	30	61	36	25	40	33	33	11
15	21	26	24	56	31	21	30	24	17	
14	17	19	16	33	27	18	20	16	13	
13	13	14	12	17	23	18	13	12	09	
12	11	08	08	17	16	18	03	07	07	
11	06	05	06	11	11	14	03	04	07	
10	04	03	04	06	07	04		03	04	
9		02	04	06	06	04		01	02	
8		01	02	06	05	04		01	02	
7		01	02	06	01			01	02	
6		01	02	06	01			01	02	
5		01		06					02	
4		01								
N	47	464	49	18	83	28	30	75	46	9
$\overline{x}$	19.7	18.6	18.9	16.2	17.7	18.1	17.9	18.0	18.9	20.0
sd	4.54	4.32	4.70	4.71	4.74	4.31	3.76	3.86	4.43	2.50

Table 9.2

Cumulative Percentage Distributions and Summary Statistics for MMPI Hs Scale Scores for Males and Females in Five Teacher Education Curriculums

Hs	Elem.		Math.		Soc.St.		Eng.		Nat.Sci.	
Scale	M	F	M	F	M	F	M	F	M	F
24		100								
23	100	99								
22	98	99								
21	98	99								
20	98	99			100					
19	98	99	100		99			100		100
18	98	98	98		99			97	100	89
17	98	97	94		99	100		97	98	89
16	98	94	94		98	93	100	96	98	78
15	98	88	94	100	90	89	90	87	93	78
14	85	81	90	94	83	75	87	80	89	78
13	66	70	80	78	72	57	77	75	74	67
12	53	55	59	72	59	39	60	55	61	44
11	45	39	43	50	48	18	40	40	41	22
10	30	21	29	39	24	14	20	27	30	11
9	17	12	20	22	16	07	10	11	22	11
8	09	05	10	22	07	04	07	04	15	
7	09	02	02	06	04			01	04	
6	06	01	02		01				02	
5	06								02	
4	04								02	
3	04									
2	04									
1	02									
N	47	464	49	18	83	28	30	75	46	9
$\bar{x}$	11.8	12.4	11.9	11.2	12.0	13.0	12.1	12.3	11.7	13.3
sd	3.54	2.63	2.65	2.38	2.54	2.20	2.14	2.50	2.72	3.04

Table 9.3

Cumulative Percentage Distributions and Summary Statistics for MMPI D Scale Scores for Males and Females in Five Teacher Education Curriculums

D Scale	Elem. M	Elem. F	Math. M	Math. F	Soc.St. M	Soc.St. F	Eng. M	Eng. F	Nat.Sci. M	Nat.Sci. F
35		100								
34		99								
33		99								
32		99								
31		99			100			100		
30		99			99			99		
29		99			99			97		
28	100	99			99			97		
27	98	99			99			97		
26	98	99			99	100		93	100	
25	98	98			99	96		92	98	
24	96	96			95	96		92	98	
23	96	94			95	96		88	96	100
22	94	91	100		92	93		85	96	89
21	87	88	98	100	88	89	100	79	93	78
20	85	82	94	89	87	82	93	76	91	67
19	77	76	88	89	81	75	87	67	91	56
18	64	65	73	83	75	64	83	56	87	33
17	53	56	61	72	64	54	77	45	70	22
16	43	44	51	61	54	39	73	39	59	11
15	21	34	41	39	45	29	57	24	52	11
14	17	23	29	22	34	14	37	17	33	11
13	15	13	18	16	06	11	23	12	17	11
12	06	08	08	06	11	04	10	04	09	11
11	02	04	04		06	04	03		04	
10		01			02	04	03		02	
9		01					03			
N	47	464	49	18	83	28	30	75	46	9
$\overline{x}$	17.5	17.3	16.3	16.3	16.6	17.5	15.5	18.4	16.0	19.0
sd	3.43	3.62	2.79	2.40	3.82	3.38	2.83	4.22	3.15	3.24

Table 9.4

Cumulative Percentage Distributions and Summary Statistics for MMPI Hy Scale Scores for Males and Females in Five Teacher Education Curriculums

Hy Scale	Elem.		Math.		Soc. St.		Eng.		Nat. Sci.	
	M	F	M	F	M	F	M	F	M	F
38	100									
37	98									
36	98									
35	98									
34	98	100								
33	98	99								
32	98	99								
31	98	99			100					
30	98	99	100		99			100		
29	96	99	98		99			99	100	
28	96	98	98		99			96	98	
27	96	98	98	100	99	100		93	98	100
26	94	93	98	89	99	93	100	92	98	89
25	89	89	94	83	90	89	97	87	89	67
24	83	84	88	83	83	82	90	71	85	67
23	70	74	78	83	77	75	70	64	76	67
22	62	62	65	67	66	54	67	55	70	56
21	51	51	61	61	59	36	50	43	61	44
20	47	38	53	50	43	21	40	32	54	22
19	36	29	47	44	37	18	37	24	48	22
18	30	22	39	39	25	14	33	17	33	11
17	21	15	27	33	16	07	17	09	24	11
16	13	07	14	22	08	07	13	05	22	11
15	06	04	10	17	07	07	03	04	11	
14	06	02	06	11	06	04	03	04	09	
13	06	01	02		06	04		01	09	
12	06				04				07	
11	06				02				07	
10	06				02					
9	04				01					
8	04				01					
7	04				01					
6	04				01					
5	04									
4	04									
3	02									
2	02									
1	02									
N	47	464	49	18	83	28	30	75	46	9
$\overline{x}$	20.6	21.4	20.2	20.2	20.7	21.9	20.8	22.0	20.0	22.3
sd	5.85	3.39	3.75	4.22	3.95	3.20	3.26	3.58	4.25	3.61

Table 9.5

Cumulative Percentage Distributions and Summary Statistics for MMPI Pd Scale Scores for Males and Females in Five Teacher Education Curriculums

Pd	Elem.		Math.		Soc.St.		Eng.		Nat.Sci.	
Scale	M	F	M	F	M	F	M	F	M	F
33									100	
32		100			100				98	
31	100	99			98				98	
30	98	99			98				98	
29	98	99	100		94		100	100	93	
28	96	98	98		89	100	97	97	91	100
27	96	96	96		82	96	97	89	89	89
26	89	93	96		80	93	87	84	80	89
25	77	90	90	100	75	86	80	83	72	67
24	68	82	84	94	66	75	67	77	70	67
23	57	74	78	94	59	68	63	71	59	56
22	36	66	67	94	48	64	53	60	48	56
21	34	56	53	83	36	50	37	52	33	56
20	23	46	45	78	28	39	30	39	24	33
19	19	36	37	72	24	25	20	31	17	22
18	13	27	31	61	20	18	13	17	13	11
17	09	20	20	44	14	18	13	13	13	11
16	09	13	12	17	10	14	10	05	09	11
15	09	08	06	11	05	07	07	03	07	
14	04	05	04	11	02	07		01	04	
13	04	02			01	07			02	
12	02	02			01					
11	02	01			01					
10		01			01					
9					01					
N	47	464	49	18	83	28	30	75	46	9
$\bar{x}$	22.6	20.9	20.8	18.4	22.7	21.3	22.3	21.8	22.8	22.3
sd	3.97	3.80	3.60	2.81	4.52	3.91	3.66	3.67	4.25	3.91

Table 9.6

Cumulative Percentage Distributions and Summary Statistics for MMPI Mf Scale Scores for Males and Females in Five Teacher Education Curriculums

Mf Scale	Elem. M	Elem. F	Math. M	Math. F	Soc.St. M	Soc.St. F	Eng. M	Eng. F	Nat.Sci. M	Nat.Sci. F
50		100								
49		99								
48		99								
47		99						100		
46		99						98		
45		97				100		96		
44		95				93		91		
43		93				89		89		
42		87		100		82		84		
41		83		94		68		75		100
40		75		89		61		64		89
39		67		72	100	57		53		89
38		60		67	99	50		48		67
37		48		50	98	50		42		67
36	100	40		50	96	39	100	37	100	67
35	98	32		39	93	21	93	24	98	33
34	98	25	100	28	92	18	83	20	98	33
33	96	19	96	22	90	14	77	16	96	22
32	96	13	94	11	89	14	73	12	94	22
31	96	10	94	06	86	14	63	07	94	22
30	91	09	88	06	78	14	63	05	87	11
29	87	06	88		72	14	60	04	78	11
28	77	04	86		61	11	57	04	78	11
27	74	03	82		53	07	47	03	70	11
26	70	02	80		46	04	33	03	63	11
25	62	02	71		39		30	03	50	11
24	51	01	59		34		20	01	48	11
23	43	01	51		25		17	01	39	11
22	40	01	37		22		17	01	33	11
21	36	01	33		16		10	01	26	11
20	26	01	24		11		03	01	20	11
19	17	01	16		06		03	01	18	11
18	11		12		05		03		09	11
17	09		08		01				04	
16	06		04		01				02	
15			02							
N	47	464	49	18	83	28	30	75	46	9
$\overline{X}$	24.2	37.3	23.8	36.7	26.9	37.8	28.5	38.1	25.0	34.4
sd	4.81	4.65	4.55	3.41	4.79	5.32	5.01	5.00	4.99	6.84

Table 9.7

Cumulative Percentage Distributions and Summary Statistics for MMPI Pa Scale Scores for Males and Females in Five Teacher Education Curriculums

Pa Scale	Elem. M	Elem. F	Math. M	Math. F	Soc.St. M	Soc.St. F	Eng. M	Eng. F	Nat.Sci. M	Nat.Sci. F
44							100			
43							97			
42							97			
41							97			
40							97			
39							97			
38							97			
37							97	100		
36							97	99		
35							97	99		
34							97	99		
33							97	99		
32							97	99		
31							97	99		
30							97	99		
29							97	99		
28							97	99		
27							97	97		
26							97	97		
25							97	97		
24			100				97	97		
23	100		98				97	97		
22	98		98				97	97		
21	98		98				97	97		
20	96		98				97	97		
19	96		98				97	97		
18	96		98				97	97		
17	96	100	98				97	97		
16	96	99	98			100	97	97		
15	96	99	98		100	96	93	97		
14	94	98	98		99	96	93	95	100	
13	91	97	98	100	96	96	90	92	98	
12	89	93	94	94	89	89	87	88	91	
11	87	82	88	89	77	71	83	81	87	100
10	74	71	82	50	70	68	63	71	70	78
9	55	57	49	44	53	39	50	45	57	67
8	40	40	41	39	37	29	30	29	37	44
7	28	22	22	22	27	14	30	23	15	22
6	17	12	10	17	14	11	20	09	11	11
5	11	05	06	06	08	07	10	08	07	
4	09	03	02	06	05	07		03	02	
3	06	01		06				03		
2	02									
1	02									
N	47	464	49	18	83	28	30	75	46	9
$\bar{x}$	9.2	9.2	9.3	9.3	9.2	9.8	10.4	10.0	9.3	8.8
sd	3.86	2.38	2.94	2.59	2.64	2.65	6.89	4.54	2.21	1.72

Table 9.8

Cumulative Percentage Distributions and Summary Statistics for MMPI Pt Scale Scores for Males and Females in Five Teacher Education Curriculums

Pt	Elem.		Math.		Soc.St.		Eng.		Nat.Sci.	
Scale	M	F	M	F	M	F	M	F	M	F
50		100								
49		99								
48		99								
47		99								
46		99								
45		99								
44		99								
43		99								
42		99								
41		99			100					
40		99			99					
39		99			99			100		
38		99			98			99		
37		98			98			99		
36		98	100		98			99	100	
35		96	98		96			99	98	
34	100	96	96		95	100		99	98	100
33	98	95	96		94	96	100	93	98	89
32	98	94	94		93	86	93	92	96	67
31	94	91	94	100	90	86	93	87	91	56
30	89	86	90	89	86	86	93	85	89	44
29	89	81	84	83	80	79	90	80	87	44
28	87	73	82	72	69	71	80	67	83	44
27	83	66	71	72	64	64	80	63	78	44
26	68	54	55	61	52	61	73	52	72	33
25	51	44	45	56	42	39	67	43	54	11
24	43	30	37	39	35	25	60	36	46	11
23	34	20	20	28	30	18	43	24	35	11
22	26	14	16	28	19	07	23	15	20	11
21	19	08	10	10	22		17	11	11	
20	13	06	06	06	13		10	04	07	
19	11	02	06	06	10			01	04	
18	09	01	04	06	07			01	02	
17	06	01	04	06	06			01	02	
16	06	01			02			01		
15	06	01			01			01		
14	06	01			01			01		
13	06	01						01		
12	04	01						01		
11	04	01						01		
10	04	01								
9	02									
N	47	464	49	18	83	28	30	75	46	9
$\bar{x}$	24.4	26.5	25.9	25.3	26.1	26.8	24.8	26.4	25.3	29.3
sd	4.97	4.15	3.89	3.91	5.04	3.45	3.54	4.31	3.76	4.18

Table 9.9

Cumulative Percentage Distributions and Summary Statistics for MMPI Sc Scale Scores for Males and Females in Five Teacher Education Curriculums

Sc	Elem.		Math.		Soc.St.		Eng.		Nat.Sci.	
Scale	M	F	M	F	M	F	M	F	M	F
41		100								
40		99						100		
39		99						99		
38		99						95		
37		99						93		
36	100	99						93		
35	98	98			100			93		
34	98	97	100		99	100		93		100
33	98	97	98		98	96		93	100	89
32	94	95	96		94	96	100	92	96	89
31	91	94	96		90	93	93	89	93	89
30	89	91	92		88	89	87	88	91	89
29	85	86	88		82	89	83	88	85	78
28	81	81	82	100	77	82	67	81	83	78
27	77	74	73	94	64	68	53	68	76	67
26	60	66	63	89	55	50	47	61	59	67
25	43	54	57	83	45	43	40	59	43	56
24	34	42	47	72	33	21	30	52	39	33
23	30	33	38	56	24	11	23	39	26	33
22	23	23	31	39	20	07	17	27	15	22
21	15	16	27	39	17	07	10	20	13	
20	09	11	16	33	12	07	03	12	04	
19	06	07	14	22	08	07	03	05	04	
18	06	05	12	06	06	04		04	04	
17	06	03	04	06	04				02	
16	06	02	04		04					
15	06	02	04		02					
14	06	01	02		01					
13	06	01	02		01					
12	06	01	02							
11	06		02							
10	06		02							
9	04		02							
8	04		02							
7	04									
6	02									
5	02									
4	02									
3	02									
2	02									
1	02									
N	47	464	49	18	83	28	30	75	46	9
$\bar{x}$	24.9	25.2	24.4	22.6	25.8	26.3	26.4	25.5	25.7	26.1
sd	6.12	4.22	4.83	3.11	4.35	3.34	3.50	4.99	3.54	3.98

Table 9.10

Cumulative Percentage Distributions and Summary Statistics for MMPI Ma Scale Scores for Males and Females in Five Teacher Education Curriculums

Ma	Elem.		Math.		Soc.St.		Eng.		Nat.Sci.	
Scale	M	F	M	F	M	F	M	F	M	F
46		100								
45		99								
44		99								
43		99								
42		99								
41		99								
40		99								
39		99								
38		99								
37		99								
36		99								
35		99								
34		99								
33		99								
32		99								
31		99			100					
30		99			99					
29		99			99					
28		99			99	100			100	
27		97			99	96		100	98	100
26		96	100		98	93		96	98	89
25	100	95	98		95	86	100	91	98	89
24	98	93	96	100	90	86	93	88	96	89
23	91	90	92	94	77	75	90	85	96	89
22	81	83	88	94	73	68	83	84	87	89
21	76	79	82	94	64	64	77	79	80	89
20	72	71	78	83	59	54	67	73	67	89
19	57	59	65	78	54	39	50	67	52	89
18	49	47	51	72	43	39	27	59	41	78
17	43	35	41	56	34	14	20	48	35	67
16	38	27	29	44	23	11	20	33	26	44
15	23	17	20	44	12	04	10	25	20	22
14	13	11	12	11	07	04	10	12	13	11
13	11	07	06	11	04	04		09	11	
12	06	04		06	04				09	
11	04	02		06	01				07	
10	04	01			01					
9	04	01			01					
8	04									
7	04									
6	04									
5	02									
4	02									
3	02									
2	02									
1	02									
N	47	464	49	18	83	28	30	75	46	9
$\bar{x}$	18.1	18.9	18.4	17.2	19.6	20.6	19.5	18.5	18.7	17.6
sd	4.60	4.00	3.24	3.10	3.97	3.67	2.99	3.91	3.74	3.81

Table 9.11

Cumulative Percentage Distributions and Summary Statistics for MMPI Si Scale Scores for Males and Females in Five Teacher Education Curriculums

Si	Elem.		Math.		Soc.St.		Eng.		Nat.Sci.	
Scale	M	F	M	F	M	F	M	F	M	F
50		100								
49		99						100		
48		99						99		
47		99						99		
46		99						99		
45		99	100		100			99		
44		99	98		99		100	99	100	
43		99	98		99		97	99	98	
42		99	98		99		97	99	96	
41		99	98		99		97	96	93	
40		99	98		96		97	96	93	
39		98	98		96		97	96	93	
38	100	98	98		96		97	93	91	
37	98	97	96		96		97	92	91	
36	98	97	96		96	100	90	91	89	
35	96	96	96	100	96	96	90	88	87	
34	96	96	96	94	94	96	90	88	85	
33	94	95	94	94	94	96	90	85	85	
32	94	93	92	94	90	89	87	85	85	
31	94	91	92	89	90	89	87	84	82	
30	94	90	90	89	90	89	87	83	82	100
29	94	89	90	89	89	89	87	81	80	89
28	91	87	88	83	88	89	83	80	80	89
27	91	83	86	83	84	89	83	77	80	89
26	89	81	80	72	84	89	77	75	78	89
25	89	79	80	72	84	86	77	69	78	89
24	89	73	78	67	77	82	73	67	78	89
23	87	69	69	61	72	79	67	64	78	89
22	83	64	63	50	72	71	57	61	74	78
21	77	60	59	44	70	61	53	57	70	78
20	66	56	49	39	63	61	50	53	65	44
19	55	50	45	28	58	43	50	48	61	33
18	55	45	37	28	55	39	47	43	54	32
17	47	39	31	28	48	39	47	35	50	33
16	43	32	27	28	41	32	47	32	41	22
15	36	25	20	22	36	29	43	27	37	11
14	28	19	16	11	30	21	33	21	24	
13	23	14	12		25	18	30	17	20	
12	17	11	10		16	14	27	12	13	
11	09	07	08		10	04	23	08	07	
10	04	03	08		04		20	04	04	
9		02	04		02		13	01	04	
8		01	02		01		06	01	04	
7		01	02		01		06	01	02	
6			02				03	01		
0			02				03	01		
N	47	464	49	18	83	28	30	75	46	9
$\overline{x}$	18.6	20.7	29.9	22.3	19.6	20.1	19.8	21.9	20.6	20.4
sd	6.41	7.17	7.76	6.19	7.78	6.51	10.04	9.20	9.49	4.48

Chapter X

In the spring, 1958, the first students in the longitudinal study who began as juniors and who made normal progress through the junior and senior years graduated. This first class was then mailed a questionnaire each year for the first four years after graduation to find whether they were teaching or not. Similarly, the graduates in 1959, 1960 and 1961 were polled to ask whether they were teaching in the years following their graduation. Results from these annual follow-up questionnaires are summarized in this chapter for four classes. The class of 1958 was followed for four years, the 1959 class for three years, the 1960 group for two years, and the 1961 group for one year. Those studied represent those in each of the teaching fields studied who were classified as juniors in the designated years and who graduated in the calendar year indicated.

The questionnaires had two common purposes: to determine 1) whether graduates were teaching; and 2) where graduates were teaching if they were teaching. These two questionnaire items were the data which were the basis for the analyses presented in this chapter.

The proportion responses to the requests for information were high by any standard. The percent who responded to each inquiry are reported in each table. The responsiveness was, in the judgment of the investigators, the result of an intensive effort to inform students about the project both before and after they graduated, a persistent campaign to maintain correct addresses, and dilligent follow-up of nonrespondents for information. In general, the degree of responsiveness permits generalizations to the total groups, but in some teaching fields where the numbers are small, the stability of the percentages and the representativeness of the data are questionable.

The Results

How many are Graduate Teaching?

Tables 10.1 through 10.8 present the percentages of the respondents who were teaching. Separate data are presented for men and women and for each of the four classes studied.

Table 10.1 presents the data from 319 women who graduated in eleven major fields during the calendar year 1958. Looking at the four distributions of percent responses, the mean percent who responded from each of the eleven fields was 86,85,82, and 83 for the four years. Only twice did the lowest percent responding fall below 70%, only 64% of the women in Art responded in the second and fourth year. Thirty-two of the percentages (73%) were 80% or above. In general, the distributions of responses from the various major fields remained constant. Of those responding, the average percent teaching in the four years was 85%, 79%, 67%, and 59%. Considered in another way, the women of the 1958 class who responded taught, on the average, 2.90 years of the first four years after graduation. Considering that four years of teaching would be the possible number of years.

Table 10.1

Percent of Female Graduates in Eleven Teaching Fields Responding and Percent of Respondents Who Were Teaching in Each of the First Four Years Beyond Their Graduation in 1958

n = 319

Teaching Field	First Yr.		Sec. Yr.		Third Yr.		Fourth Yr.	
	% R*	% T**	% R	% T	% R	% T	% R	% T
Elementary IA n = 178	85	91	87	82	89	70	89	62
Elementary IIIA n = 25	72	89	80	80	80	75	88	52
Elementary IB n = 40	98	95	83	73	93	62	95	58
English n = 18	94	65	94	65	83	47	72	38
Foreign Language n = 11	91	90	91	100	82	89	91	80
Language Arts n = 6	83	80	83	100	83	80	83	60
Social Sciences n = 4	100	75	75	33	75	33	75	33
Art n = 14	79	82	64	89	71	90	64	67
Business n = 7	71	100	100	71	86	83	86	50
Music n = 7	100	71	86	83	86	50	71	60
PEW n = 9	78	100	89	88	78	57	100	89
Average	86	85	85	79	82	67	83	59

*Percent responds

**Percent teaching

Table 10.2 presents data from the four follow-up studies of the men (n = 166) in ten teaching majors. The average of the responses to the first year inquiry was 85% with only one group falling below 70% response. The mean of the second and third year distributions of percent responses changed little, but in the fourth year the median was 90%. The average percent teaching in each of the four years was 78%, 85%, 76%, and 73%. For the total of the four years beyond graduation the males in the ten major fields who responded to the questionnaires taught a total of 3.13 years on the average. Since four years teaching are the maximum number of years each member of the class could teach, the 3.13 average years taught is 78% of the possible teaching time for the men in the 1958 class.

Table 10.3 presents the returns from the studies of the 1959 class of women graduates (n = 353) who had entered the College as juniors. The distributions of percent responses was unusually high the first year after graduation with only one field having below an 80% return and with an average return of 91%. Responses fell sharply the second year, partly a result of the small numbers in some fields, to an average response of 78%. The response in the third year follow-up was comparable to the second year. Of the women of the 1959 class who responded, 85%, on the average, were teaching the first year after graduation, 75% the second, and 56% the third. The percent of the 1959 class teaching the first two years is similar to the percentages for equivalent periods for the 1958 class. For the three years beyond graduation, the 1959 class taught 2.15 years on the average or 72% of the possible years taught.

Table 10.4 shows the data from the ten groups of men in the 1959 class by major fields. Of 180 men those responding to the three inquiries averaged 89%, 73%, and 68%, and the table shows the variability from field to field. The men in the 1959 class did not reply at the uniformly high rate of the 1958 class. Of those who responded 80%, 83%, and 81% were teaching in the three years after graduation. Over the total three year period, these men taught 2.44 years on the average. This represents 81% utilization of the graduates preparation for teaching.

Table 10.5 summarizes the data for the 371 women in the 1960 class. 95% responded to the request for information in their first year after graduation and 85% the second year. In the first year, 80% of those responding indicated they were teaching and 72% were teaching the second year. For the first two years after graduation the women in the 1960 class taught, on the average, 1.52 years. This represents a utilization of 76% of the preparation for teaching.

Table 10.6 presents the data for the men (n = 180) in the 1960 class in ten teaching fields. 95% of the men responded to the request for information the first year and 89% the second year. Of those who responded, 77% were teaching the first year and 79% were teaching the second. For the two years following their graduation, these men taught 1.56 years, on the average, representing a 78% utilization of the preparation for teaching.

Table 10.7 reports data from the one year follow-up of women who began as juniors and graduated in 1961. Of the total of 399, 94% responded and 81% were teaching. These women, then, taught .81 years, on the average, or an 81% utilization of the preparation for teaching.

Table 10.2

Percent of Male Graduates in Ten Teaching Fields Responding and Percent of Respondents Who Were Teaching in Each of the First Four Years Beyond Their Graduation in 1958

n = 166

Teaching Field	First Yr.		Sec. Yr.		Third Yr.		Fourth Yr.	
	% R*	% T**	% R	% T	% R	% T	% R	% T
Elementary IA n = 23	91	81	91	90	96	86	96	91
English n = 8	88	100	88	86	88	100	88	86
Math n = 12	100	83	83	90	83	80	92	82
Natural Science n = 11	100	82	91	80	91	70	100	73
Social Science n = 23	83	68	78	78	74	65	91	62
Art n = 14	86	50	79	73	93	54	93	54
Business n = 12	75	89	83	90	75	78	75	78
Industrial n = 28	68	74	79	91	86	75	86	79
Music n = 8	75	100	100	88	88	71	88	57
PEM n = 27	85	61	85	87	81	82	92	67
Average	85	79	85	85	85	76	90	73

*Percent responds

**Percent teaching

Table 10.3

Percent of Female Graduates in Eleven Teaching Fields Responding and Percent of Respondents Who Were Teaching in Each of the First Three Years Beyond Their Graduation in 1959

n = 353

Teaching Field	First Yr.		Sec. Yr.		Third Yr.	
	% R*	% T**	% R	% T	% R	% T
Elementary IA n = 174	95	93	76	85	76	68
Elementary IIIA n = 27	96	96	78	90	74	80
Elementary IB n = 45	96	93	73	79	78	66
English n = 23	91	90	83	79	70	69
Foreign Language n = 11	100	82	82	78	82	44
Language Arts n = 12	83	90	83	70	83	40
Social Sciences n = 9	78	57	44	75	44	25
Art n = 20	90	89	75	73	85	59
Business n = 6	83	80	83	60	83	60
Music n = 10	90	67	80	50	89	63
PEW n = 16	94	93	75	83	56	44
Average	91	85	76	75	75	56

*Percent responds

**Percent teaching

Table 10.4

Percent of Male Graduates in Ten Teaching Fields Responding and Percent of Respondents Who Were Teaching in Each of the First Three Years Beyond Their Graduation in 1959

n = 180

Teaching Field	First Yr.		Sec. Yr.		Third Yr.	
	% R	% T	% R	% T	% R	% T
Elementary IA n = 31	97	93	68	81	55	88
English n = 8	75	83	63	80	63	80
Math n = 18	100	78	78	57	72	62
Natural Science n = 11	100	82	82	89	82	89
Social Science n = 27	78	86	70	79	63	71
Art n = 4	100	75	100	100	100	100
Business n = 12	83	70	58	71	67	63
Industrial n = 36	86	77	86	84	72	77
Music n = 12	92	64	58	100	58	100
PEM n = 21	81	94	67	86	52	82
Average	89	80	73	83	68	81

*Percent responds
**Percent teaching

Table 10.5

Percent of Female Graduates in Eleven Teaching Fields Responding and Percent of Respondents Who Were Teaching in Each of the First Two Years Beyond Their Graduation in 1960

n = 371

Teaching Field	First Yr.		Sec. Yr.	
	% R*	% T**	% R	% T
Elementary IA n = 185	94	87	88	81
Elementary IIIA n = 20	95	89	80	94
Elementary IB n = 38	97	81	79	73
English n = 26	88	61	77	50
Foreing Language n = 9	89	88	78	71
Language Arts n = 5	100	60	100	60
Social Sciences n = 21	95	55	100	52
Art n = 21	95	85	86	67
Business n = 7	100	86	100	71
Music n = 17	94	100	65	91
PEW n = 22	95	86	82	83
Average	95	80	85	72

*Percent responds

**Percent teaching

Table 10.6

Percent of Male Graduates in Ten Teaching Fields Responding and Percent of Respondents Who Were Teaching in Each of the First Two Years Beyond Their Graduation in 1960

n = 180

Teaching Field	First Yr.		Sec. Yr.	
	% R*	% T**	% R	% T
Elementary IA n = 24	100	83	96	87
English n = 8	88	86	75	83
Math n = 31	97	77	97	67
Natural Science n = 17	94	69	94	69
Social Science n = 28	86	67	86	75
Art n = 5	100	100	60	100
Business n = 6	100	100	100	100
Industrial n = 26	92	67	96	72
Music n = 11	100	73	100	82
PEM n = 24	96	48	83	50
Average	95	77	89	79

*Percent responds
**Percent teaching

Table 10.7

Percent of Female Graduates in Eleven Teaching Fields Responding and Percent of Respondents Who Were Teaching in the First Year Beyond Their Graduation in 1961

n = 399

Teaching Field	Percent Responds	Percent Teaching
Elementary IA n = 213	95	92
Elementary IIIA n = 23	91	86
Elementary IB n = 32	94	100
English n = 43	95	85
Foreign Language n = 13	100	77
Language Arts n = 8	88	57
Social Sciences n = 14	93	77
Art n = 15	100	67
Business n = 9	78	100
Music n = 9	100	56
PEW n = 20	100	90
Average	95	81

Table 10.8 gives the responses from the 192 men in the 1961 class. 79% of the men responded and 72% of those were teachin in their first year after graduation. This represents .72 years taught on the average, a utilization of 72%.

In summary, several points are worth noting. Considering the four classes as a total group, 83% of the women taught their first year after graduation compared to 77% of the men. For the three classes polled in the second year beyond graduation, 75% of the women and 82% of the men were teaching. For those three years beyond graduation, 62% of the women were teaching compared to 79% of the men. Considering all classes totalled for all of the years, the utilization of preparation for teaching was 70% for women and 78% for men. A large percent of the women than men teach the first year after graduation, but the percent of men teaching the second year increases over the first and the percent decreases only moderately the third and fourth years. The percent of women teaching decreases steadily each year.

Table 10.8

Percent of Male Graduates in Ten Teaching Fields Responding and Percent of Respondents Who Were Teaching in the First Year Beyond Their Graduation in 1961

n = 192

Teaching Field	Percent Responds	Percent Teaching
Elementary IA n = 27	93	92
English n = 15	100	73
Math n = 25	100	72
Natural Science n = 23	100	79
Social Science n = 27	93	44
Art n = 6	100	100
Business n = 11	91	60
Industrial n = 26	96	72
Music n = 7	100	57
PEM n = 25	92	70
Average	97	72

Where do graduates teach?

Tables 10.9 through 10.16 report where graduates were teaching. Each table reports the percentage of graduates who responded to the request for information, and the percent of the respondents who were teaching in Minnesota schools or in schools outside the state. Those teaching in Minnesota schools are reported as teaching either in Metropolitan schools (Minneapolis, St. Paul, Duluth, and their adjoining suburbs) or other Minnesota schools. It should be noted that the percentages in the three geographical classifications do not total 100% unless all of those who responded were teaching. The percent of the respondents who were not teaching is not identified directly. As in the previous section, the data are presented separately for men and women in each class, 1958 through 1961.

Table 10.9 reports the data for the women in the 1958 class. Of those who responded the first year after graduation (81%), 70% were teaching in Minnesota schools and 22% outside the state, a ratio of 3.18:1. The second year after graduation the decrease in the percent of respondents who were teaching (from 92% to 80%) was due to the decreased percentage who were teaching in "other Minnesota schools", which dropped to an average 15% from the 27% who taught the first year. The drop to an average of 66% teaching the third year following graduation was due to about equal decreases in the percent teaching in each of the three geographic areas. The decreases the fourth year to 59% of respondents teaching were due primarily to the decreases in the number of those teaching in Minnesota schools. By the fourth year the proportion teaching in Minnesota schools had dropped to 2.47:1.

Table 10.10 reports the data for the 165 men in the 1958 class. When compared to the women in the same graduating class, the most obvious difference is the proportion who teach in Minnesota compared to those teaching in other states. The first year after graduation the ratio was 3.00:1, and the proportion increased each year until those who reported they were teaching in Minnesota four years after graduation compared to those who were teaching elsewhere were in a ratio of 4.46 to 1.

Tables 10.11 and 10.12 report where the men and women in the class of 1959 were teaching. The data for the three years studied are quite comparable to the responses from the 1958 class. The ratios vary somewhat from those of the 1958 class because the percentage of women teaching in Minnesota decreased faster over the three years than was true for the 1958 class while the percentage of those women teaching in other states remained constant. The number of men in the 1959 class teaching in Minnesota was equal to the number in the previous class. In contrast to the previous class, however, the 1959 class of men showed a larger percentage teaching in other states the third year after graduation. For the women in the 1959 class, the ratios of those teaching in-state to others for the three years were (1) 3.68:1, (2)2.04:1, and (3) 2.37:1. For the men the ratios were (1) 3.58:1, (2) 4.53:1, and (3) 3.50:1.

The percentages in the 1960 class, Tables 10.13 and 10.14, who were teaching in the first two years beyond graduation did not follow a pattern like either of the two preceding classes. In the first year after

Table 10.9

Percent of Female Graduates in Eleven Teaching Fields Responding and Percent of Respondents Who Were Teaching in Minnesota Metropolitan, Other Minnesota Schools or Outside the State in Each of the First Four Years Beyond Their Graduation in 1958

n = 319

Teaching Field	First Year				Second Year				Third Year				Fourth Year			
	% Resp.	Minn Metro	Minn Other	Outside Minn.	% Resp.	Minn Metro	Minn Other	Outside Minn.	% Resp.	Minn Metro	Minn Other	Outside Minn.	% Resp.	Minn Metro	Minn Other	Outside Minn.
Elem. IA n = 178	82	58	8	27	82	49	8	24	84	39	5	24	82	29	8	21
Elem. IIIA n = 25	68	65	12	18	68	59	6	18	76	53	0	21	88	38	0	14
Elem. IB n = 40	98	62	10	23	80	44	3	25	90	36	8	17	88	29	9	17
English n = 18	89	38	6	25	78	36	14	14	83	27	7	13	72	23	8	8
For. Lang. n = 11	82	67	22	11	91	50	20	30	82	56	22	11	82	44	22	22
Lang. Arts n = 6	67	0	50	50	83	40	40	20	83	40	20	20	83	40	20	0
Soc. Sci. n = 4	75	0	67	33	50	0	0	50	75	0	0	33	75	0	0	33
Art n = 14	79	64	0	18	64	67	0	22	71	70	10	10	64	44	0	22
Business n = 7	71	60	20	20	100	43	14	14	86	50	17	17	86	17	17	17
Music n = 7	100	14	43	14	71	20	40	20	86	17	33	0	71	20	20	20
PEW n = 9	78	43	57	0	89	63	25	0	78	29	14	14	100	56	22	11
	81%	43%	27%	22%	78%	43%	15%	22%	81%	38%	12%	16%	81%	31%	11%	17%

Table 10.10

Percent of Male Graduates in Ten Teaching Fields Responding and Percent of Respondents
Who Were Teaching in Minnesota Metropolitan, Other Minnesota Schools, or Outside
the State in Each of the First Four Years Beyond Their Graduation in 1958

n = 165

Teaching Field	First Year				Second Year				Third Year				Fourth Year			
	% Resp.	Minn Metro	Minn Other	Outside Minn.	% Resp.	Minn Metro	Minn Other	Outside Minn.	% Resp.	Minn Metro	Minn Other	Outside Minn.	% Resp.	Minn Metro	Minn Other	Outside Minn.
Elem. IA n = 22	95	67	10	5	91	65	15	10	91	60	20	5	82	61	28	0
English n = 8	88	71	0	29	88	57	0	29	75	83	0	17	75	83	0	0
Math n = 12	100	42	17	25	83	50	10	30	75	67	11	11	92	45	27	9
Nat. Sci. n = 11	100	45	27	9	91	60	10	10	91	50	10	10	91	50	10	10
Soc. Sci. n = 23	83	21	21	26	74	41	12	24	74	18	12	35	87	25	10	25
Art n = 14	71	0	20	40	79	9	27	36	93	8	31	15	93	23	15	15
Business n = 12	75	44	33	11	67	50	50	0	75	22	44	11	75	22	33	22
Industrial n = 28	71	35	5	30	86	38	8	38	82	43	4	26	79	45	5	27
Music n = 8	75	17	67	17	88	29	71	0	75	33	33	0	88	14	29	14
PEM n = 27	85	35	22	4	85	43	39	4	81	45	32	5	88	26	35	4
	84%	38%	22%	20%	83%	44%	24%	18%	81%	43%	20%	14%	85%	39%	19%	13%

Table 10.11

Percent of Female Teachers in Eleven Teaching Fields Responding and Percent of Respondents
Who Were Teaching in Minnesota Metropolitan, Other Minnesota Schools or Outside
the State in Each of the First Three Years Beyond Their Graduation in 1959

n = 353

Teaching	First Year				Second Year				Third Year			
Field	% Resp.	Minn Metro	Minn Other	Outside Minn.	% Resp.	Minn Metro	Minn Other	Outside Minn.	% Resp.	Minn Metro	Minn Other	Outside Minn.
Elementary IA n = 174	88	69	10	16	68	57	3	23	71	40	6	20
Elementary IIIA n = 27	85	74	9	13	70	68	0	21	67	61	0	17
Elementary IB n = 45	84	68	18	11	53	54	4	21	69	58	0	6
English n = 23	87	55	20	20	74	41	12	24	70	31	6	31
Foreign Language n = 11	100	45	9	27	64	29	29	14	82	22	11	11
Language Arts n = 12	83	20	50	20	83	40	10	20	83	20	0	20
Social Science n = 9	67	33	17	17	44	25	0	50	44	25	0	0
Art n = 20	85	65	12	18	75	47	7	20	80	25	6	25
Business n = 6	83	40	40	0	67	0	25	25	67	25	25	0
Music n = 10	70	14	29	43	80	25	13	13	89	13	13	38
PEW n = 16	81	38	38	23	69	18	27	36	56	11	22	11
	83%	47%	23%	19%	68%	37%	12%	24%	71%	30%	8%	16%

Table 10.12

Percent of Male Graduates in Ten Teaching Fields Responding and Percent of Respondents Who Were Teaching in Minnesota Metropolitan, Other Minnesota Schools, or Outside the State in Each of the First Three Years Beyond Their Graduation in 1959

n = 180

Teaching Field	First Year				Second Year				Third Year			
	% Resp.	Minn Metro	Minn Other	Outside Minn.	% Resp.	Minn Metro	Minn Other	Outside Minn.	% Resp.	Minn Metro	Minn Other	Outside Minn.
Elementary IA n = 31	94	79	7	10	58	56	6	22	52	56	13	19
English n = 8	63	80	20	0	63	60	20	0	50	75	0	0
Math n = 18	78	36	29	21	72	23	15	15	67	25	8	25
Natural Science n = 11	91	40	20	20	64	29	43	14	82	44	33	11
Social Science n = 27	74	50	15	25	59	38	13	31	59	38	13	25
Art n = 4	75	67	33	0	75	100	0	0	100	100	0	0
Business n = 12	75	44	22	11	58	43	29	0	67	38	13	13
Industrial n = 36	75	22	15	48	78	29	11	43	72	38	12	27
Music n = 12	83	10	40	20	42	40	60	0	50	0	67	33
PEM n = 21	71	13	40	33	48	0	60	20	52	27	27	27
	78%	44%	24%	19%	62%	42%	26%	15%	65%	44%	19%	18%

graduation, a smaller percentage of both men and women taught in Minnesota than was true of previous classes, and a larger percent taught in other states. For the women the ratios were (1) 2.24:1 and (2) 2.27:1. In the second year after graduation, the proportion of women teaching was comparable to previous classes. For the men the ratio of those teaching in-state to those out-of-state decreased the second year from 2.67:1 to 1.73:1, caused by both a smaller percent teaching in Minnesota and a larger percent teaching elsewhere.

Tables 10.15 and 10.16 report the responses from men and women in the 1961 class. In their first year after graduation, the ratios of those teaching in Minnesota to those teaching in other states was 2.24:1 for women and 3.24:1 for men. Though the ratio for women in somewhat lower than the comparable first year figure for other classes, the ratio for the men is comparable.

In summary, this discussion of the survey of where graduates taught has not considered separately the individual major fields for either men or women. While these data are presented in the tables and may be of interest to those in particular teacher preparation fields, they do seem to warrant discussion individually. Where graduates in a particular field teach is no doubt a function of the supply and demand characteristics of that field. No attempt has been made to identify factors that may be related to these major field patterns.

It may be worth noting that for all of the years beyond graduation for all of the classes, a composite total of ten years of experience, the women who taught in Minnesota compared to those who taught in other states is indicated by a ratio of 2.59:1. The ratio for men was 3.32:1. If the follow-up each year after graduation is considered separately for all of the graduating classes, then the trend is for the proportion teaching in Minnesota to decrease for the women and increase for the men. The number of women from the four classes who responded that they were teaching in Minnesota decreased in the years beyond graduation as compared to those who taught in other states. The reverse was true for the men who reported they were teaching.

Table 10.13

Percent of Female Teachers in Eleven Teaching Fields Responding and Percent of Respondents Who Were Teaching in Minnesota Metropolitan, Other Minnesota Schools, or Outside the State in Each of the First Two Years Beyond Their Graduation in 1960

n = 371

Teaching	First Year				Second Year			
Field	% Resp.	Minn Metro	Minn Other	Outside Minn.	% Resp.	Minn Metro	Minn Other	Outside Minn.
Elementary IA n = 185	92	60	12	16	86	56	11	15
Elementary IIIA n = 20	95	68	16	5	80	69	19	6
Elementary IB n = 38	95	50	8	22	79	50	7	17
English n = 26	88	35	13	13	77	25	10	15
Foreign Language n = 9	78	71	14	14	78	57	14	0
Language Arts n = 5	100	0	20	40	100	20	0	40
Social Science n = 21	81	29	12	12	95	25	5	25
Art n = 21	86	44	17	22	86	33	11	22
Business n = 7	100	14	14	57	100	29	0	43
Music n = 17	82	14	36	50	65	27	27	36
PEW n = 22	91	50	15	25	77	41	18	24
	90%	40%	16%	25%	84%	39%	11%	22%

Table 10.14

Percent of Male Graduates in Ten Teaching Fields Responding and Percent of Respondents Who Were Teaching in Minnesota Metropolitan, Other Minnesota Schools, or Outside the State in Each of the First Two Years Beyond Their Graduation in 1960

n = 180

Teaching Field	First Year				Second Year			
	% Resp.	Minn Metro	Minn Other	Ouside Minn.	% Resp.	Minn Metro	Minn Other	Outside Minn.
Elementary IA n = 24	100	63	8	13	96	70	4	17
English n = 8	88	0	43	43	75	17	33	33
Math n = 31	97	40	20	17	97	33	17	17
Natural Science n = 17	94	31	25	13	88	40	13	20
Social Science n = 28	86	13	29	25	86	8	29	38
Art n = 5	100	20	60	20	60	33	33	33
Business n = 6	100	33	33	33	100	0	33	67
Industrial n = 26	88	52	0	17	96	48	0	24
Music n = 11	100	0	55	18	100	0	55	27
PEM n = 24	92	18	18	14	79	11	21	16
	95%	27%	29%	21%	88%	26%	24%	29%

Table 10.15

Percent of Female Teachers in Eleven Teaching Fields Responding and Percent of Respondents Who Were Teaching in Minnesota Metropolitan, Other Minnesota Schools, or Outside the State in the First Year Beyond Their Graduation in 1961

n = 399

Teaching Field	First Year			
	% Resp.	Minn Metro	Minn Other	Outside Minn.
Elementary IA n = 213	93	64	14	16
Elementary IIIA n = 23	91	71	5	10
Elementary IB n = 32	91	66	14	21
English n = 43	88	29	21	34
Foreign Language n = 13	92	25	8	42
Language Arts n = 8	88	14	0	43
Social Science n = 14	93	54	8	15
Art n = 15	93	43	0	29
Business n = 9	78	14	71	14
Music n = 9	100	22	11	22
PEW n = 20	100	30	35	25
	92%	39%	17%	25%

Table 10.16

Percent of Male Graduates in Ten Reaching Fields Responding and Percent of Respondents Who Were Teaching in Minnesota Metropolitan, Other Minnesota Schools, or Outside the State in the First Year Beyond Their Graduation in 1961

n = 192

Teaching Field	First Year % Resp.	Minn Metro	Minn Other	Outside Minn.
Elementary IA n = 27	85	65	17	13
English n = 15	93	29	21	21
Math n = 25	100	28	28	16
Natural Science n = 23	100	17	39	22
Social Science n = 27	89	29	4	13
Art n = 6	100	50	33	17
Business n = 11	91	0	40	20
Industrial n = 26	92	33	17	25
Music n = 7	100	0	57	0
PEM n = 25	92	26	17	26
	94%	28%	27%	17%